# Energy in the Indian Sub-Continent

*Author: R K Pachauri, Director, Tata Energy Research Institute, New Delhi*

*Co-author Gurneeta Vasudeva, Research Associate, Tata Energy Research Institute, New Delhi*

***Submitted to:***
Petroleum Economist Limited
PO Box 105, Baird House
15/17 St. Cross Street
London EC1N 8UN

## Table of contents

Executive Summary

Chapter 1 Political scenario
1 1 Overview
1 2 Political systems country profile
    1 2 1 India
    1 2 2 Pakistan
    1 2.3 Bangladesh
1 3 Foreign policy
    1 3 1 India
    1 3 2 Pakistan
    1 3 3 Bangladesh

Chapter 2 Economic indicators
2 1 The need for economic reform
2 2 An overview of the reform process
2 3 Fiscal indicators
2 4 Trade policy core concerns
    2 4 1 Trade and labour standards
    2 4 2 Trade and environment
    2 4 3 The role of regionalism

Chapter 3 Energy demand and supply
3 1 Energy-economy indicators
3 2 Energy demand
    3 2 1 Fuel structure
    3 2 2 Sectoral energy consumption
3 3 Energy supply
    3 3 1 Coal
    3 3 2 Oil
    3 3 3 Natural gas
    3 3 4 Renewable energy
    3 3 5 Power

Chapter 4 Energy outlook
4 1 Coal
4 2 Oil
4 3 Natural gas
4 4 Power

Chapter 5 Energy security concern
5 1 Energy security concerns for South Asia
5 2 The potential for oil supply disruption
5 3 Major concerns for oil supplying countries
    5 3 1 Iran
    5.3.2 Iraq
    5 3 3 Libya
    5.3 4 Nigeria
    5 3 5 Indonesia
5 4 Oil supply disruptions lessons from the past
5 5 Response strategies
    5 5 1 Strategic stockpiles
    5 5 2 Demand restraint
    5 5.3 Technology interventions

Chapter 6 Prospects for investments in the energy sector
- 6.1 Imperatives for resource mobilization
- 6.2 Investment requirements
  - 6.2.1 India
- 6.3 Reform indicators
- 6.4 Private sector financing in the power sector

Chapter 7 Energy policy in India
- 7.1 Coal
  - 7.1.1 Policy for private sector investments
  - 7.1.2 Pricing policy
  - 7.1.3 Fiscal policy
  - 7.1.4 Legislative reforms
  - 7.1.5 Environmental considerations
  - 7.1.6 Augmentation of transport infrastructure
- 7.2 Oil
  - 7.2.1 New Exploration Licensing Policy
  - 7.2.2 Policy for private sector participation in refining
  - 7.2.3 Environmental concerns for refineries
    - 7.2.3.1 Product quality standards
  - 7.2.4 Pricing policy
    - 7.2.4.1 Pipeline tariffs
    - 7.2.4.2 Trend in international oil prices
  - 7.2.5 Regulatory reform
    - 7.2.5.1 Road map for disinvestment
  - 7.2.6 Augmentation of transport infrastructure
    - 7.2.6.1 Crude and product pipelines
    - 7.2.6.2 Port infrastructure
- 7.3 Natural gas
  - 7.3.1 Pricing policy
  - 7.3.2 Regulatory reform
  - 7.3.3 Augmentation of transport infrastructure
- 7.4 Power
  - 7.4.1 Policy for private sector investments
    - 7.4.1.1 Mega power projects
    - 7.4.1.2 Liquid fuel-based power projects
    - 7.4.1.3 Hydroelectric projects
    - 7.4.1.4 Nuclear power projects
  - 7.4.2 Pricing policy
  - 7.4.3 Regulatory reform
  - 7.4.4 Augmentation of transmission and distribution infrastructure
- 7.5 Renewable energy
  - 7.5.1 Policy for private sector investments

Chapter 8 Energy policy in Pakistan
- 8.1 Oil and gas
  - 8.1.1 Exploration and production
  - 8.1.2 Refining
  - 8.1.3 Pricing policy
    - 8.1.3.1 Oil
    - 8.1.3.2 Natural gas
  - 8.1.4 Augmentation of transport infrastructure
    - 8.1.4.1 Oil
    - 8.1.4.2 Natural gas

8 2 Power
  8 2 1 Policy to encourage private sector investments
  8 2 2 Pricing policy
  8 2 3 Success of the privatization policy a comparative analysis

Chapter 9 Energy policy in Bangladesh
9 1 Oil and gas
  9 1 1 Policy for upstream investments
  9 1 2 Policy for downstream investments
  9 1 3 Pricing policy
  9 1 4 Augmentation of transport infrastructure
9 2 Power
  9 2 1 Policy for private sector investment
  9 2 2 Pricing policy
  9 2 3 Augmentation of transmission and distribution infrastructure
9 3 Renewable energy
  9 3 1 Policy encouraging private sector investments

Chapter 10 Key national and international players in the energy sector
10 1 National companies
  10 1 1 National Thermal Power Corporation
  10 1 2 Powergrid Corporation of India
  10 1 3 Water and Power Development Authority (WAPDA)
  10 1 4 Karachi Electric Supply Corporation
  10 1 5 Oil and Natural Gas Commission
  10 1 6 Pakistan Oilfields Limited
  10 1 7 Sui Southern Gas Company (SSCG)
  10 1 8 Petrobangla
10 2 International companies
  10 2 1 Unocal
  10 2 2 Tullow
  10 2 3 Enron
  10 2 4 Shell

Chapter 11 Integrating energy markets in South Asia
11 1 The imperatives for integrating energy markets
11 2 Exploring the oil and gas markets in Central Asia
  11 2 1 Prospects for oil exports
  11 2 2 Prospects for gas exports
11 3 Prospects for LNG imports from the Middle East
11 4 Prospects of gas pipelines from the Middle East
11 5 Prospects of a gas pipeline from Bangladesh
11 6 Acquiring acreage overseas
  11 6 1 Central Asia
  11 6 2 Middle East
  11 6 3 Venezuela
11 7 Power exchange between the countries of the region
11 8 Development of renewable energy technologies

Chapter 12 Conclusions and recommendations
12 1 Changes in governance
12 2 Regulatory institutions
12 3 Knowledge creation and exchange
12 4 Technology development
12.5 Demand side management
12 6 Integration of energy markets

Annexure A
  - A 1 Interview with Mr R P singh, CMD, Power Grid Corporation of India Limited
  - A 2 Interview with Mr B C Bora, CMD, Oil and Natural Gas Corporation
  - A 3 Interview with Mr Rajendra Singh, CMD, Thermal Power Corporation, India

Annexure B

Annexure C

# Executive Summary

The South Asian region is of importance to the world energy market because it contains 1.3 billion people, close to a quarter of the world's population, and is experiencing a rapid growth in energy demand, concomitant with economic growth and industrialization. This report addresses issues relevant to the development of the energy sector, common to most countries in the region with a special emphasis on the energy scenario in India, Pakistan and Bangladesh. Providing adequate energy supply is a major challenge facing these economies, leading to the formulation of policies with increased incentives for energy imports, foreign investments and regional cooperation. The report therefore aims to provide an overview of the existing political and economic conditions in the countries of the region, thereby assessing the current environment and future prospects for economic liberalization and implementation of policies relevant for investments in the energy sector. It also examines the existing energy demand and supply balance, and reviews the policies and programmes to meet the future energy requirements.

The political conditions in the countries of the region, have a direct impact on the future prospects for economic liberalization and implementation of policies relevant for investments in the energy sector. Internal conflicts, along with continuing poverty and alienation of the masses from mainstream economic and political systems, form the biggest challenge to the democratic process in the region. In addition, the polity faces the challenges of corruption, poverty, unstable coalitions, regionalism and strife. In most countries in South Asia, the extent of bureaucratic involvement in the political process has been exceptionally high and often the bureaucracy has performed the twin functions of policy formulation and its execution. In countries such as Pakistan, Bangladesh and Nepal where the democratic traditions are still quite fragile, a conflict in domain has caused several institutional clashes. In India, as regional parties become stronger, unwieldy and unstable coalitions have become unavoidable, leading to frequent elections at an immense financial cost. In the multiple role of a peoples' representative, regulator, and law-maker, the parliament is vital in expressing the sovereign will of the people, however, several challenges persist in this respect.

In the context of the developing countries in South Asia, the best route for ensuring economic growth and prosperity is through economic openness and liberal trade and investment policies Most countries of the region have adopted a policy of economic openness, including trade liberalization, exchange rate convertibility on current and capital accounts, deregulation of interest rates, privatization of loss-making enterprises, and other reforms in pricing, taxation and expenditure, thereby providing access to new technologies, skills, resources and promoting market discipline and hence maintaining international competitiveness and attracting Foreign Direct Investment (FDI) The implementation of economic reform, however, has been hindered largely due to institutional failures and poor governance

In most countries of the region, the many demands placed on the state to meet a widening range of social and economic needs has strained the capacity of the state to continue financing energy enterprises In addition, financial constraints on account of the fiscal deficit and balance of payments situation has made an adverse impact on investments in the energy sector Given the growing trend towards financial integration, developing countries need to pursue policies that will benefit from global capital flows. In this respect the most important pre-requisite for successful financial integration is a sound macroeconomic policy framework that includes, a strong fiscal position, the absence of price distortions, a sound domestic banking system, and adequate legal and regulatory framework These preconditions improve the creditworthiness of the country, and encourage capital flows in the longer term (World Bank, 1999)

A World Bank survey of the privatization process in developing countries shows that on an average only 39% of energy sector reform, defined as the process facilitating private ownership and competition, was achieved by mid-1998 The survey results have demonstrated that formal regulation or restructuring of the power and upstream oil and gas sectors has been much less than private investment itself This is because most countries are in the process of augmenting investments by allowing private investments for new sites with a contract for sale to the state-owned utility, rather than preparing for privatization and the creation of competitive markets

There exist several opportunities, both economically and technologically feasible, for integrating energy markets in Asia Based on the analysis of future energy demand and supply in South Asia, it is evident that energy imports from outside the region would increase substantially raising concerns relating to the security of supply, and necessitating the need for fuel diversification and diversification of the source of the fuel itself In this respect, the oil and gas rich Central Asian region, which has the advantage of geographical proximity to South Asia assumes great significance However, inadequate infrastructure, and investments in production and technological upgradation have greatly constrained the development of the hydrocarbon resources in the Central Asian region There is therefore, immense potential for the upstream oil and gas companies to invest in exploration and production in the region and develop it as an alternative to indigenous resources that are fast depleting Similar initiatives are required in the oil and gas rich South-east Asia and the Middle East

There exists a vast potential for utilizing the water resources of Bhutan and Nepal for power generation and exporting the surplus electricity generated, in exchange for technical and financial assistance Similarly, given the large prognosticated gas reserves in Bangladesh, it would be worthwhile to examine the feasibility of setting-up gas pipelines vis-a-vis power generating plants and exporting the surplus power Considering the success of independent power producers in Pakistan, there exists significant economic benefit in exporting the surplus power to India, which has been analyzed as being technologically feasible but has not materialized due to geopolitical constraints

Finally, it can be said that regional integration is complementary to wider trade and economic liberalization, and in this respect, some of the initiatives that need to be adopted include, (i) creation of knowledge networks (ii) capacity-building programmes (iii) policies to facilitate technology-transfer (iv) sharing of experiences in regulation and governance (v) developing a joint strategy for promoting energy-efficiency and reducing energy intensity (vi) promoting renewable energy technologies (vii) developing a common strategy for resource mobilization

# Chapter 1: Political scenario

## 1.1 Overview

This chapter provides an overview of the political conditions in the countries of the region, thereby assessing the current environment and future prospects for economic liberalization and implementation of policies relevant for investments in the energy sector.

There has been little uniformity in the nature of political systems across South Asia. Democracy, monarchy, and authoritarianism have all existed at different points in time. Democracy is firmly entrenched in India and Sri Lanka, but has often been disrupted by periods of direct and indirect military rule in Pakistan and Bangladesh. While Nepal has adopted democracy after an extended monarchial rule, the Maldives has adopted a presidential system, and Bhutan still functions under a benign and liberal monarchy

Internal conflicts, along with continuing poverty and alienation of the masses from mainstream economic and political systems, form the biggest challenge to the democratic process in the region In India, the democratic process has been uninterrupted, with a resilient institutional mechanism (World Bank, 1999) However, here too democracy faces the challenges of corruption, poverty, unstable coalitions, regionalism and strife Sri Lanka, starting as a liberal and progressive democracy, has been witnessing growing social intolerance, increasing militarization, and erosion of institutions in recent times

In most countries in South Asia, the extent of bureaucratic involvement in the political process has been exceptionally high and often the bureaucracy has performed the twin functions of policy formulation and its execution In these countries a military-bureaucratic oligarchy forms a major segment of the governing elite Ideally the primary function of the bureaucracy is to function under the directions of the representative government and act within the framework of law. The armed forces have entered politics when the civilian political groups lacked legitimacy, electoral support and effective executive power In Bangladesh and Pakistan, military rule has prevailed for almost half their political history. Conversely, in India and Sri Lanka, political systems have witnessed effective civilian control over the military. The ruling civilian regimes, however, maintain a strong reliance on the military in the context of internal security, and in varying degrees in other spheres of social and economic activity.

Dynastic politics is another important feature of the political process in South Asia India has perhaps known the longest single family rule in the region The domination of dynastic politics is symptomatic of the widespread belief that political power is derived from patronage rather than performance and of deification of political leadership

The failure to deliver tangible social and economic benefits through centralized regimes in the socialist and third world countries has encouraged decentralization and local level participation in South Asia, as in other parts of the world Economic liberalization has also spurred decentralization, and many international lenders are strongly supporting this trend In India, for instance, a consensus has emerged for the establishment of a local government system or 'panchayati raj' in each state, so as facilitate better governance keeping in view the enormous social, cultural and ethnic diversity of the population

While both India and Pakistan continue to cling to the fragile and euphemistic federal structures, much is needed to implement the basic principles of autonomy and decentralization The confused notion of federalism has led to a growth in civic problems, increased regional disparities, and to an unbalanced fiscal relationship between the centre and the state governments. The competition for government resources sets the stage for acrimony between the central authorities and federal units, leading to regional disputes, demands for greater autonomy and secessionist tendencies

There is an impending need to revisit the spending and revenue responsibilities of the centre and the state In India for instance, the state is responsible for over half of the public spending, but generates only 40% of the revenue In Pakistan the imbalance is even more serious, with provincial governments accounting for only 6% of the revenue but as much as 25% of the spending The central government collects most taxes including the more important ones such as income tax and customs duty, while almost 80%-90% of the public spending on social services is made at the lower levels of the government, thereby necessitating a transfer of funds and resulting in scope for manipulation

Distribution of revenue across the states also needs rationalization In India, distribution is based on criteria such as income levels, state tax performance, and the degree of backwardness This formula has proven to be quite egalitarian in terms of ensuring greater funds for the less developed states, yet, regional disparities in living standards have been observed to increase, in part, due to discretionary grants In Pakistan, allocation continues to be determined by the population share as provided by the population census of 1981 The disproportionate size of the majority province of Punjab, which accounts for over half the population, presents a major challenge to this system Punjab not only leads the country in development indices, it also receives the bulk of federal revenues and subsidies, concessional credit and direct public sector investments The smaller provinces in Pakistan are therefore continuously asking for a remodeling of the allocation formula on a more equitable basis, as in the case of India.

In most of South Asia, the main political institutions are the legislature, the executive and the judiciary that function to legitimize as well as monitor political authority

The parliament or the legislative assembly, comprises peoples' representatives, with powers to amend the constitution (within certain limitations), enact laws, generate revenue, allocate resources, levy taxes and spend money from the national treasury While law-making and deliberations on proposed government action are primarily the functions of the legislature, the Supreme Court performs a parallel function of law-making by setting precedents through its rulings The executive, which comprises the Prime Minister, the cabinet ministers and the bureaucracy is required to be collectively responsible to the parliament, by executing the policies approved in the parliament However, a conflict in domain has caused several institutional clashes, which are most visible in Pakistan, Bangladesh and Nepal, where democratic traditions are still quite fragile In India, as regional parties become stronger, unwieldy and unstable coalitions have become unavoidable leading to frequent elections at immense financial cost. In the multiple role of a peoples' representative, regulator, and law-maker, parliament is vital in expressing the sovereign will of the people, however, several challenges persist in this respect

In the case of Pakistan, the cabinet also reserves law-making powers through 'Presidential Ordinances', under which the parliament and provincial assemblies have been dissolved several times. The army too has dissolved the parliament and provincial assemblies time and again and has indulged in constitutional re-engineering The judiciary in Pakistan has also played a significant role in re-shaping the parliamentary system, and in justifying the act of dissolution of parliament. The clash between the judiciary and executive in 1997 resulted in the removal of the Chief Justice after the government sought control over the appointment, promotion and removal of judges, and the latter retaliated by removing the constitutional amendment safeguarding the solidarity of the elected parliament More recently, the military authorities declared a state of emergency and suspended the constitutional and provincial assemblies. In Bangladesh, the parliament faces a subservient role to the executive, which uses it to legitimize its own rule while remaining unaccountable itself Moreover, successive military governments have by-passed the parliament and manipulated its composition.

One of the most crucial reforms that is required in South Asia is the restructuring of the institution of civil service. One of the common problems faced by the people throughout the region is the bureaucratic obstruction in the implementation of policies As the implementation arm of the government, it is essential for the bureaucracy to perform the functions of maintaining law and order, providing a regulatory framework, promoting social and economic development and encouraging a participatory form of governance, efficiently and responsibly.

A basic institutional requirement that has been recognized by most South Asian constitutions is the need for separating the judiciary from the executive While this has been largely implemented in India, it is yet to be achieved in the other countries of the region The Indian judiciary has also been successful in expanding the frontiers of judicial review thereby redressing the abuse of executive powers and the failure to perform legal duties

In conclusion, it can be said that economic and social progress is not possible amidst political instability and a weak institutional framework The lack of good political governance has harmed the South Asian economies in the past and it is therefore necessary to create a democracy based on strong institutions that function within a legal and regulatory framework, so as to reap the benefits of globalization.

## 1.2 Political systems: country profile

### *1.2.1 India*

During the 1950s and 1960s the economic policies adopted by the government comprised largely social reform and emphasized secularism and equality The focus was largely on a bureaucratic approach to economic management that emphasized reliance on internal resources and downplayed the importance of external trade Under the rubric of socialism, the government refrained from adopting an export-oriented growth strategy and encouraging foreign investment In fact, India's share in the world trade declined throughout the 1970s Moreover, the oil crisis in 1973 and the drought in 1973 and 1974 increased inflation and lowered the standard of living thus leading to discontentment and a widespread agitation against the ruling Congress government Consequently in 1975, a state of emergency was declared, which apparently saw some gains in administrative efficiency and a reduction in the rate of inflation, but curbed civil liberties which the public found unacceptable

Strict anti-monopoly laws and emphasis on equity shares in the past, have discouraged operations of joint ventures and multinationals Paradoxically, however, due to the failure in mobilizing domestic resources efficiently, the government has relied heavily on foreign assistance to fund the plan outlay. An analysis of the economic conditions brings to light an increasing shortfall between the government revenue and expenditure, both on the capital and current accounts. The current account expenditure also increased during the early 1980s due to an increase in the defence spending and also due to large subsidies on fertilizers, and petroleum products. Moreover, the antiquated and inefficient tax structure, relying upon direct taxation, thereby encouraging evasion, contributed to the current account deficit (Hewitt V, 1997).

In the period 1984-89, the economic policy adopted by Rajiv Gandhi as Prime Minister and leader of the Congress, was largely conciliatory and progressive, and the government embarked upon reforms that were representative of the new generation. In 1985, the budget initiated a process of economic reform and liberalization, which has continued since then and in some respects marked the end of the Nehruvian approach of a planned economy However, some of the reforms, especially the cutting back of subsidies was perceived as an anti-poverty alleviation strategy by the opposition as well as some of the Congress factions Rajiv Gandhi's most significant achievement however, was the reversal of the fiercely, power-oriented, centralized approach, and the initiation of a dialogue with the leaders of the regional parties A much needed reform in the tax structure was also introduced during this period, under the leadership of V P Singh as Finance Minister However inadequate implementation of the tax reforms due to the government's reluctance in recovering revenues from large corporate organizations, largely as a result of political pressures, mitigated the success of the reform process

In 1991, faced with a simultaneous foreign exchange and fiscal crises the Indian economy was in a parlous state, thereby necessitating a programme for economic reform In the elections held in 1991, it was clear that no one party would win an outright majority and that the political stalemate would persist. While assuming leadership of the Congress led coalition, it was clear that Narasimha Rao's government was faced with the challenges of Hindu nationalism, communal unrest, and regional separatist movements, nevertheless, he utilized the initial period of his premiership for initiating a programme of economic restructuring Dr Manmohan Singh, was inducted as the Finance Minister to spearhead the reform process He carried out a number of emergency measures including a substantial devaluation of the rupee and a stringent curb on imports At the same time assistance was sought from the IMF, which led to a partial stabilization of the economic situation It was a widely accepted view that a departure from the existing economic policy was necessary and this was implemented in the 1991 and 1992 budgets. During this period, almost the entire economic machinery was dismantled, the rupee was made partially convertible, the banking system was overhauled and foreign investment was encouraged. Though some of these measures were unpopular with the opposition, the rapidly expanding middle class responded favourably to the new economic initiatives

The positive developments on the economic front however, were marred by the rise of communal problems stemming from the BJP's ideological claim for Hindutva (Hinduness) which represented the interests of India's majority. In the period 1994-95, while the reforms were further consolidated, and continued to show results, the government took several initiatives to show its commitment to social welfare Rao's government however, faced the charges of being too willing to accept external interference in economic management. This issue gained prominence with the launch of a campaign against the signing of the new General Agreement of Tariffs and Trade accord or the Dunkel Draft.

As the 1996 elections approached each party began to establish an agenda to appeal to the electorate in terms of social justice and economic policies. While the Congress was able to accentuate the significant results that the new economic policies were beginning to deliver, reflected largely in the low inflation rates, the BJP emphasised that economic development was to be achieved without allowing indiscriminate entry of foreign capital The BJP demonstrated its beliefs by canceling the Dabhol power project, the first major foreign investment in the power sector, when it came to power in the state of Maharashtra.

Though the project was later renegotiated, it led to the loss of credibility in terms of potential foreign investors. The BJP continued to project itself as a strongly nationalist party, although with lesser stress on the Hindutva ideology. A part of the anti-liberalization argument of the BJP was that it would not serve to alleviate poverty and create further disparity between the rich and poor sections of society.

On assuming power in 1996, the United Front government which emerged as a coalition of the National and Left fronts, drew up a common minimum programme committed to a combination of economic reform and anti-poverty policies. An effort by the Finance Minister, P Chidambaram to raise the price of petroleum products achieved only partial success in the face of opposition not only from the BJP but the Minister's own supporters and allies. Other signals of potential problems dissipated from on-going conflict between the states of Karnataka and Tamil Nadu over the allocation of water resources The political climate, therefore made it difficult for the government to advance its programme of economic reform, and important decisions over the increase in petroleum product prices and the privatization of the insurance sector for instance, were either postponed or evaded

In 1998, a coalition government was formed under the leadership of Atal Behari Vajpayee of the BJP. It was clear that Vajpayee's government had the most tenuous hold on power and that the Prime Minister would require to exercise both tact and skill to retain his position. Although the partners in the coalition government produced a national agenda for governance, it was clear that the government policies would not proceed uninterrupted

After a few weeks of a seemingly lack lustre government, the testing of the nuclear devices in May 1998, led to popular enthusiasm amongst the masses However, the action perceived as provocative led to the nuclear tests by Pakistan, and consequently a negative international response, leading to sanctions on foreign aid and investments (EIA, 1999) The government has nevertheless, carried the process of economic reform forward and implemented policies for liberalization of trade and industry. In the year 1999/2000 economic growth is estimated at 5.9%, and more importantly industrial recovery seems to be finally underway after the cyclical downturn of the previous two years, as evident from the rise in the stock market Inflation also dropped to international levels of 2%-3% for the first time in decades The rise in foreign exchange reserves, coupled with a stable exchange rate has demonstrated that the balance of payments situation survived the twin shocks of the East Asian crisis as well as the post Pokhran sanctions.

### 1.2.2 Pakistan

Even though the economic policy in Pakistan has been quite liberal, it has nonetheless been tied-up with the interests of particular regimes In the post-independence period, Pakistan's economic policy was quite the reverse of India's, thereby leading to higher economic growth rates, and a larger share in world trade Policies for economic liberalization, were most successful in their implementation under the leadership of General Mohammad Ayub Khan The country benefited from export promotion and diversification, which laid the foundation for the development of the steel and petrochemicals industries The momentum however declined during the political crisis that overtook the country during the 1960s, thereby leading to a decline in foreign exchange inflows, and inflationary pressures as a result of the war with India in 1965 (Hewitt V, 1999)

Following the civil war in 1971, Zulfikar Ali Bhutto, became President and pursued a populist agenda, nationalizing the major industries and the banking system In 1973, he promulgated a new constitution accepted by most political elements and relinquished the presidency to become the new Prime Minister of Pakistan. Although, Bhutto continued his populist and socialist rhetoric, the economy stagnated, largely as a result of the dislocation and uncertainty produced by his frequently changing economic policies.

In July 1977, owing to the increasing political unrest and allegations of rigging in the elections by Bhutto, the Chief of the Army Staff, Gen. Zia-ul-Haq declared martial law, suspended parts of the 1973 constitution and became the Chief Martial Law Administrator Democracy in Pakistan returned in 1988, under the leadership of Benazir Bhutto, who formed a coalition government. However, differing interpretations of constitutional authority, debates over the powers of the central and provincial governments, the antagonistic relationship between the Bhutto administration and the opposition governments in Punjab and Baluchistan seriously impeded social and economic reforms. In addition, ethnic conflict, primarily in the Sindh province, fragmentation in the government coalition and the military's reluctance to support an apparently ineffectual and corrupt government, further exacerbated these problems and led to a deterioration in the law and order situation

Until the recent military coup, Nawaz Sharif was probably the most secure and powerful Prime Ministers of Pakistan. Under his leadership the Islamic Democratic Alliance (IDA), achieved important political victories. The implementation of the economic reforms program, involving privatization and deregulation greatly improved Pakistan's economic performance and investment climate. The three primary objectives cited by the Sharif government at the time of inception were recovery from the economic crisis, removal of corruption and institutional reform In October 1997, the government secured a $ 1 6 billion IMF assistance program expected to trigger support from other financial institutions as well as boost investor confidence

In October 1999, the democratically elected Pakistan Muslim League government led by Prime Minister Nawaz Sharif was replaced by a military led government as a result of a coup The Army Chief General Pervez Musharraf assumed the role of the Chief Executive heading both the National Security Council and the new cabinet comprising military and non-military personnel The international response to the coup was restrained with most governments expressing the desirability of a return to democracy Within the country, the response to the coup was muted, largely in recognition of the fact that all was far from well in a country where the last four democratically elected governments had each failed to see a full term

The coup came at a critical juncture for the energy sector in Pakistan The foreign companies eager to exploit their recent discoveries of gas reserves were concerned at the inevitable delays and lack in progress in decisions to exploit these finds. In July 1999, the Sharif government had announced proposals to alter the producer gas pricing structure The tariff dispute between the government and IPPs was yet to be resolved Also the Privatization Commission was in the process of implementing plans for privatization of Pakistan's two state-owned gas utilities the Sui Northern Gas Pipelines Limited and Sui Southern Gas Company Limited

The importance of Pakistan's oil and gas resources in the future development of the country is clearly recognized by the new government This is evident from the signing of petroleum concession agreements, the approval of the proposed gas pricing structure, and the announcement of the economic revival package. Though these events clearly demonstrate the government's commitment to the reform process the implementation of the effectiveness of the government policies is yet to be seen.

### *1.2.3 Bangladesh*

After the independence of Bangladesh in 1971 the AL (Awami League) government under the leadership of Mujib-ur Rahman was committed to socialist principles and initiated the process of nationalization of industrial and commercial enterprises As economic conditions continued to remain precarious, the government focussed on relief, rehabilitation and reconstruction of the economy In December 1974, Mujib proclaimed a state of emergency, taking into account the continuing economic deterioration and civil disorder, and introduced a constitutional amendment limiting the powers of the legislature and the judiciary, establishing an executive presidency and instituting a single party system The government adopted a policy encouraging foreign investment and introduced the New Investment Policy in 1974, restoring rights to private and foreign investors. Despite some improvement in the economic situation during the first half of 1975, implementation of the promised political reforms was slow and criticism of the government policies increased

Successive military coups resulted in strengthening the Army Chief of Staff, Gen Ziaur Rehman, who pledged the army's support to the civilian government At the behest of Gen Zia, the parliament was dissolved and martial law was instituted. Under the Martial Law Administration, Zia sought to invigorate government policy and administration and promulgated the Revised Investment Policy, thereby allowing greater private sector participation and authorizing joint ventures with public sector corporations in previously reserved sectors, even though the government continued to retain 51% of the ownership The Dhaka Stock Exchange was reactivated in 1976, and the Bangladesh Investment Corporation was established the same year to provide financing for bridge construction and underwriting facilities for the private sector. In 1978, investment ceilings for private investment were abolished and the government adopted a amore liberal attitude towards foreign direct investment through the Foreign Private Investment (Promotion and Protection) Act. Growth in investments, however, remained slow and the industrial sector continued to be dominated by relatively inefficient public enterprises, governed by an elaborate system of administrative controls.

Under the leadership of Gen Ershad, the government introduced a New Industrial Policy, in June 1982, calling for a significant increase in private sector activity and denationalization of selected public sector enterprises In 1986, the government announced a comprehensive revision of its industrial policy, setting out objectives and strategies to accelerate the pace of industrialization. The policy also emphasized private and foreign investment in high technology, export oriented and labour intensive industries, liberalized the tariff structure, and reduced quantitative import restrictions. The power generation, transmission and distribution sectors, however, continued to remain under the public sector till the late 1980s. Among other public sector enterprises the Bangladesh Petroleum Corporation was consistently profitable and was therefore not privatized. In 1987, an amendment to the Bangladesh Industrial Enterprise (Nationalization) Ordinance was adopted, providing for the legal basis to sell up to 49% of the shares in the remaining public sector enterprises

Policies promoting economic liberalization gained momentum in the late 1980s and have been furthered by both the Bangladesh National Party (BNP) under the leadership of Begum Khaleda Zia and the AL government under the leadership of Sheikh Hasina According to the World Bank, almost 600 state-owned enterprises were disinvested in by 1986. However the process came to a standstill after this, and in 1993 the BNP government under the leadership of Begum Khaleda Zia established the Privatization Board to expedite the process of disinvestment The BNP government adopted market-based policies to increase the economic growth rate, downsize the role of the government, encourage private sector investments and attract foreign investments The BNP government also attempted to reduce the current account deficits, and increase tax revenue, by expanding the tax base (despite stiff opposition, the Value Added Tax was introduced in 1992) and improving collection and administration With an increase in revenues, efforts are being made to increase the proportion of development projects that can be financed from domestic resources, thereby reducing the country's dependency on foreign aid (EIU, 1999).

The AL has pursued policies similar to those of the former BNP government. Given the country's electricity supply shortage the government issued a Private Sector Power Generation Policy, to solicit proposals from Independent Power Producers. Foreign investments in the oil and gas sector have also been encouraged by the government

The first four budgets presented by the AL government have emphasized broadening of the tax base, tightening of tax administration and streamlining of tariff rates In 1999, the AL government continued to liberalize the import duty structure by reducing the highest rate of duty and eliminating previously existing anomalies in the duty structure These measures were seen as essential in order to strengthen incentives for domestic production

The fiscal deficit, however persists at 5% of GDP, owing to high expenditures and revenue shortfalls Revenue collection in 1998/99 was 100% below the targeted level, largely due to the devastating floods, that wrecked the economy The government's expenditure on relief and rehabilitation rose significantly, and also necessitated the augmentation of donor assistance in addition to the $ 338 million loan from the World Bank and IMF for emergency imports

Monetary policy has been used sparingly by successive governments as an instrument of economic policy, partly because strict controls over monetary growth would place severe constraints on the fragile banking system. About 50% of the combined portfolio of the nationalized commercial banks and private domestic banks, was classified as non-performing loans in 1997. The AL government has introduced some changes in the legal framework to facilitate bad debt collection, and some progress has been made, although the reform process is likely to progress at a slow pace.

In the recent months, political tensions have increased again, following violent clashes between political rivals, and though Prime Minister Hasina has promised to hold fresh elections in the year 2000, the offer has been rejected by the BNP and the Jamaat-e-Islami Party who have been demanding Hasina's resignation.

Despite the controversy that has continued during the AL's three year rule, Sheikh Hasina's government can be credited with a treaty with India on water-sharing with the Ganges, a peace treaty with the tribal rebels in the Chittagong Hill tracts, thereby ending a 20-year period of insurgency, the completion of the multi-purpose bridge over the river Jamuna, and the rehabilitation of the economy which had experienced a downslide since the floods in 1998. However, the government continues to face an uphill task in augmenting infrastructure and restoring the law and order situation that has continued to worsen in the recent years.

## 1.3 Foreign policy

### *1.3.1 India*

During the 1950s India's foreign policy was largely that of non-involvement and focused towards the creation of a force of non-aligned nations However, Nehru's plan for the creation of a non-aligned bloc led by India in alliance with China was abandoned with the Chinese aggression in 1962 thus paving the way for closer ties with the Soviet Union

In 1971 a conflict with Pakistan was precipitated, leading to a large refugee population from East Pakistan, which was later declared as Bangladesh Safeguarding the policy of non-alignment, in August 1971, India signed a treaty with the Soviet Union promising mutual support short of actual military involvement India's relations with Bangladesh started on a high note owing to its role in the 1971 conflict However, the assassination of the Bangladeshi Prime Minister Mujibur Rahman in 1975, made the political leaders in Bangladesh wary of India's overpowering status in the sub-continent. The most important bilateral issue between India and Bangladesh has been the sharing of the Ganges river water and the construction of the controversial barrage on the Indian side.

Negotiations on the issue extended over several years and finally an agreement that was perceived as fair and equitable was signed in 1996.

The testing of India's first nuclear device in May 1974 provided a serious setback to the relations with Pakistan and resulted in much criticism throughout the world In the recent years the issue of Kashmir has been the central factor in determining the relations with Pakistan While the arms race between the two countries has continued, one of the most important achievements in the recent years was the decision taken by the Foreign Secretaries to formulate working groups to discuss bilateral issues, including the Kashmir issue Although the perceptions on what should constitute the agenda for discussions differed significantly, the fact that a dialogue could be initiated had opened up the possibility of a broader convergence of interests in the future However, the process of initiating a dialogue has stalled due to the conflicts that have arisen in the intervening period

The inclusion of Sikkim in India, led to straining of relations with Nepal Relations with Nepal further deteriorated in 1989, when India decided not to renew the treaties related to trade and transit, insisting that a common treaty covering both the issues be negotiated Subsequently, India responded to Nepal's refusal for considering two separate treaties, by closing most of the transit points vital to Nepal's trade In 1990, however, a joint agreement was signed for restoring the trade relations and reopening of the transit points In 1997, the government also announced the opening of a new transit route between Nepal and Bangladesh via the north-eastern states.

India's foreign policy has been an area fraught with difficulties, nevertheless it has provided opportunities to improve the government's domestic image. In the case of Sri Lanka for instance, the Indian government put a considerable pressure on the Sri Lankan government to accept the offer of an Indian mediated agreement with the LTTE, with the Indian Peace Keeping Force overseeing the agreement. In July 1987 50,000 Indian troops were dispatched to Tamil areas in Sri Lanka. While the policy brought several accolades to the government in the initial stages, the situation rapidly turned against the government as the IPKF encountered a considerable resistance from the Tamil militants and suffered a large number of casualties. In 1989 an agreement was signed for the withdrawal of military forces form Sri Lanka, and a promise for restoration of peace and normalcy.

India's relations with the US, improved in the 1980s, despite the general perception of the US being favourably disposed towards Pakistan and China India's programme of economic reforms has been welcomed by the US, and the Indian policy makers have realized the importance of the goodwill of the US government in its future investments and trade opportunities. Nevertheless, the US has been making consistent efforts to reverse India's nuclear and missile programmes, through negotiations with Pakistan.

### *1.3.2 Pakistan*

Pakistan's early foreign policy espoused non-alignment, and involved membership in the Commonwealth of Nations and the United Nations, with no commitment to the United States Pakistan's foreign policy stance shifted significantly in 1953 when it accepted military and economic assistance from the United States, in exchange for membership in an alliance system designed to contain international communism When the administration of Eisenhower sought a series of alliances in the Northern Tier comprising Pakistan, Turkey and Iran, and East Asia, Pakistan became a candidate for membership in each

Disputes between India and Pakistan over the Kashmir issue have persisted since 1947, even though the circumstances surrounding the conflict have changed considerably over the years In the recent years, the situation has become more complex with a growing militant movement for an independent Kashmir, precluding accession to neither India nor Pakistan The volatile and potentially explosive situation in Kashmir, thus, continues to be a major deterrent to improved economic and geopolitical relations between the two countries Tensions between the two countries was heightened, with the Indian testing of nuclear devices in May, 1998, followed by nuclear tests in Pakistan In response to the nuclear tests, the United States imposed congressionally mandated sanctions on India and Pakistan, which hampered economic growth in the countries.

By far, the most significant sanctions were the suspension of the US government credits and guarantees, and the opposition to further loans from International Financial Institutions. Suspension of Japan's foreign aid programme also had a sizeable impact on the economy in Pakistan The suspension of the US sanctions and resumption of international lending has allowed a modest recovery from the financial crisis, with the foreign exchange reserves increasing from $ 415 million in November 1998 to $ 1.84 billion in March 1999 Pakistan has also reached an agreement with the Paris Club on rescheduling the US $ 3 billion short-term external debt, so as to enable structural adjustments in the economy (EIA, 1999)

In an effort to improve bilateral relations and sharing more information on the nuclear program, India and Pakistan held a summit in Lahore in February 1999, only the third since 1947 However, the armed conflict in Kargil that followed, and the arms race that persists between the two countries has greatly deterred efforts for bilateral trade and regional cooperation

The Soviet invasion of Afghanistan has had a profound effect on Pakistan's geopolitical situation. Pakistan became a frontline state during the Cold War, providing a base for the mujahidin forces against the Soviet forces and Afghan communists and a conduit for military assistance by the United States to the Afghan militia However, with the disintegration of the Soviet Union and the emerging oil and gas rich, Central Asian republics, Pakistan is compelled to reassess its foreign policy in relation to Afghanistan in order to establish linkages with Central and West Asia.

Pakistan seeks to expand relations with other South Asian countries, particularly Bangladesh Although, certain issues arising from the civil conflict that created Bangladesh in 1971 still remain unresolved, formal relations were established between the two countries in 1976 Pakistan is also a member of the South Asian Association for Regional Cooperation (SAARC), which was founded through the efforts of the Bangladeshi President Ziaur Rehman large number of casualties. In 1989 an agreement was signed for the withdrawal of military forces form Sri Lanka, and a promise for restoration of peace and normalcy.

India's relations with the US, improved in the 1980s, despite the general perception of the US being favourably disposed towards Pakistan and China. India's programme of economic reforms has been welcomed by the US, and the Indian policy makers have realized the importance of the goodwill of the US government in its future investments and trade opportunities. Nevertheless, the US has been making consistent efforts to reverse India's nuclear and missile programmes, through negotiations with Pakistan.

### *1.3.2 Pakistan*

Pakistan's early foreign policy espoused non-alignment, and involved membership in the Commonwealth of Nations and the United Nations, with no commitment to the United States Pakistan's foreign policy stance shifted significantly in 1953 when it accepted military and economic assistance from the United States, in exchange for membership in an alliance system designed to contain international communism When the administration of Eisenhower sought a series of alliances in the Northern Tier comprising Pakistan, Turkey and Iran, and East Asia, Pakistan became a candidate for membership in each

Disputes between India and Pakistan over the Kashmir issue have persisted since 1947, even though the circumstances surrounding the conflict have changed considerably over the years In the recent years, the situation has become more complex with a growing militant movement for an independent Kashmir, precluding accession to neither India nor Pakistan The volatile and potentially explosive situation in Kashmir, thus, continues to be a major deterrent to improved economic and geopolitical relations between the two countries Tensions between the two countries was heightened, with the Indian testing of nuclear devices in May, 1998, followed by nuclear tests in Pakistan In response to the nuclear tests, the United States imposed congressionally mandated sanctions on India and Pakistan, which hampered economic growth in the countries.

By far, the most significant sanctions were the suspension of the US government credits and guarantees, and the opposition to further loans from International Financial Institutions. Suspension of Japan's foreign aid programme also had a sizeable impact on the economy in Pakistan. The suspension of the US sanctions and resumption of international lending has allowed a modest recovery from the financial crisis, with the foreign exchange reserves increasing from $ 415 million in November 1998 to $ 1.84 billion in March 1999 Pakistan has also reached an agreement with the Paris Club on rescheduling the US $ 3 billion short-term external debt, so as to enable structural adjustments in the economy (EIA, 1999).

In an effort to improve bilateral relations and sharing more information on the nuclear program, India and Pakistan held a summit in Lahore in February 1999, only the third since 1947 However, the armed conflict in Kargil that followed, and the arms race that persists between the two countries has greatly deterred efforts for bilateral trade and regional cooperation

The Soviet invasion of Afghanistan has had a profound effect on Pakistan's geopolitical situation Pakistan became a frontline state during the Cold War, providing a base for the mujahidin forces against the Soviet forces and Afghan communists and a conduit for military assistance by the United States to the Afghan militia. However, with the disintegration of the Soviet Union and the emerging oil and gas rich, Central Asian republics, Pakistan is compelled to reassess its foreign policy in relation to Afghanistan in order to establish linkages with Central and West Asia.

Pakistan seeks to expand relations with other South Asian countries, particularly Bangladesh Although, certain issues arising from the civil conflict that created Bangladesh in 1971 still remain unresolved, formal relations were established between the two countries in 1976 Pakistan is also a member of the South Asian Association for Regional Cooperation (SAARC), which was founded through the efforts of the Bangladeshi President Ziaur Rehman.

Pakistan has been an active member of the UN and has received assistance from the UN development organizations, including the United Nations Development Program (UNDP) which allocated about $ 87 million in the period 1992-96, and the Food and Agriculture Organization (FAO) In addition, Pakistan has played a leading role in the Organization of the Islamic Conference (OIC), which was revitalized as a forum for periodic meetings of the heads of Islamic states Pakistan, thus, appears to recognize the utility of broad-based international cooperation

### 1.3.3 Bangladesh

Bangladesh has pursued a moderate foreign policy that relies heavily on multinational diplomacy, especially at the United Nations Since 1975, the government has sought close relations with other Islamic countries and has been a prominent member of the OIC Efforts have also been made to expand cooperation amongst countries in South Asia An initiative of the former President Ziaur Rehman led to the formation of the SAARC in 1985 Bangladesh has also made extensive efforts to extend cooperation to nations of South-east Asia through the Association of South-east Asian Nations (ASEAN)

The government has participated in numerous international conferences especially those dealing with population, food, development and women's issues In 1982 Bangladesh played an active role as Chairman of the 'Group of 77', an informal association encompassing most of the developing countries in the world

Relations between India and Bangladesh, however, have not been without strain The fact that the two nations are so closely intertwined with about 2400 km of common border, shared river systems, and cultural and economic contacts, has led to numerous instances for bilateral disputes The 1980s marked a new era for Indo-Bangladeshi relations, with both countries drawing up a Memorandum of Understanding for Technical Cooperation and conducting the first meeting of the Joint Economic Commission A bilateral trade pact was also extended from 1986 to 1989 An inland trade and transit protocol, allowing Indian vessels to pass through Bangladesh, wherein, India would pay the transit and port fees and Bangladesh would maintain its waterways, the Ganges water sharing agreement and the CHT peace accord of 1996, and the more recent agreement allowing overland transshipment facilities to India, have further improved bilateral relations with India necessitated by Bangladesh's geographical position (EIU, 1999).

References:

1 Hewitt V. 1997. **The new international politics of South Asia** Manchester University Press. Great Britain

2 EIA 1999 **Country Analysis Briefs Energy Information Administration** United States, Department of Energy

3 EIU 1999 *Country Profile· Bangladesh.* The Economist Intelligence Unit United Kingdom

4 World Bank 1999 **Human Development in South Asia**. Oxford University Press Karachi, Pakistan.

# Chapter 2: Economic indicators

## 2.1 The need for economic reform

In the context of the developing countries in South Asia, the best route for ensuring economic growth and prosperity is through economic openness and liberal trade and investment policies  Empirical studies indicate that a policy of economic openness stimulates growth through easier access to new technologies, skills, resources and promotion of market discipline (ADB, 1999)  Liberal trade and investment policies also assist in maintaining international competitiveness and attracting Foreign Direct Investment (FDI)  According to a study conducted by the Asian Development Bank (ADB), the average economic growth rate in the period 1965-1990 was about 2% higher in those Asian economies that adopted outward oriented policies

In the late 1980s nearly all South Asian countries have undergone a series of economic reforms as a part of the structural adjustment and liberalization process, implemented under the umbrella of the World Bank and the International Monetary Fund (Table 2 1)  Recent economic reforms include trade liberalization, exchange rate convertibility on current and capital accounts, deregulation of interest rates, privatization of loss-making enterprises, and other reforms in pricing, taxation and expenditure

**Table 2.1 Calendar of economic reform**

| Country | Year |
|---|---|
| Bangladesh | 1989 |
| India | 1991 |
| Nepal | 1991 |
| Pakistan | 1988 |
| Sri Lanka | 1989 |

*Source* World Bank, 1999

Some of the results of the economic reform process in South Asia have been positive, including a decline in budgetary deficits, a lowering in the share of trade taxes in the total tax revenues, a decline in the average tariff rates and an increase in the foreign direct investment

The implementation of economic reform however, has been hindered largely due to institutional failures and poor governance. Some of the issues that need to be addressed in this respect are (IMF. 1999):

- Even though there has been a lowering in the average rate in trade tariff, it still remains higher than the global average.
- External trade liberalization has not been accompanied by internal and regional liberalization. Domestic trade is accompanied by significant taxes, though control on external trade has been largely abolished. In India, for instance, inter-state sale of goods is subject to high taxation. Similarly, while trade with countries outside the region may have increased, there is very little increase in trade between the countries of the region
- Financial sector reforms remain incomplete Public sector banks are still burdened by a large proportion of non-performing loans.
- Deficit reduction is slow and lacks continuity
- There has been a larger emphasis on reducing expenditures rather than mobilizing additional revenues Efforts have been made to increase the taxation rates and introduce new taxes rather than increasing the existing tax base
- While the governments have provided incentives for foreign investment, political and institutional instability has diminished the positive impacts of these incentives
- The privatization of public enterprises has failed to match the potential In the post liberalization period the total proceeds from foreign investments was a mere 2% of the GDP in most countries of the region
- Frequent devaluation of the exchange rates has reduced the anti-export bias, however, the region has fallen short of achieving the optimal export performance
- Institutional and legal reform remain inadequate for facilitating the process of economic reform.

The recent financial crisis in South-east Asia, which has been attributed to inconsistencies in the economic structure and policies, masked by healthy macro-economic indicators, has raised serious questions about the role of economic openness in the long-term development strategy. The impact of economic openness on economic vulnerability and volatility are issues that have been under debate for a long time Economic and empirical evidence clearly demonstrate that outward-oriented policies should be a central part of the development strategy in the developing countries and the financial crisis does not change this, however, it does raise questions about the desirability of completely free capital movement and full capital account convertibility

The important lesson learnt is that while capital inflows can be an important source of economic dynamism by providing resources for investment in developing countries, they can also cause excessive economic volatility in countries with unstable financial systems and poor regulatory frameworks Countries in South-east Asia that allowed unfettered movement of capital suffered heavily, while those in South-Asia that permitted limited mobility have remained relatively unscathed by the crisis. In addition, due to the long gestation periods, high costs, and irregular revenue flows, infrastructure projects rely heavily on long-term financing, which is quite ill developed due to the limited range of financial instruments and liquidity necessary for infrastructure financing The implementation of an appropriate incentive framework and improved governance are therefore needed if the financial sector is to support economic growth effectively (World Bank 1997).

## 2.2 An overview of the reform process

In India, after several decades of pursuing a protectionist "import substitution" trade policy with severe limitations on foreign investments, policy changes have been implemented to encourage trade and foreign investment. Tariffs on imported goods have been lowered or completely eliminated as in the case of equipment for large-scale power generation In addition, restrictions on foreign ownership have been relaxed

Given the enormous resource requirement in the infrastructure sectors, the government has evolved a policy encouraging greater private sector investment However, the obstacles including the absence of an appropriate regulatory framework, lack of incentives, poor coordination amongst the various government agencies in implementation of projects and unavailability of long-term funds need to be resolved in this context (EIA, 1999)

Efforts are also required to accelerate the pace of reform in the areas of public finance consolidation, and financial and capital markets, so as to achieve sustainable infrastructure development and hence, economic growth (ADB, 1999) As regards public sector reform, the policy so far has focussed on efforts to mobilize resources by broadening the tax base and revising the tax rate structure. Initiatives are also required to strengthen the non-tax revenues, including implementation of an appropriate pricing policy for utilities, rationalizing expenditures and curtailing subsidies.

Recently, foreign investments in India have been affected by a number of factors including the uncertainty associated with the Asian currency crisis and investors' concerns arising from the nuclear tests in May 1998 which led to the G-7 sanctions on aid and multilateral lending. These factors have adversely affected the capital inflows which fell from about $ 15.1 billion in 1997/98 to $ 7.6 billion in 1998/99

In Pakistan, low rates of saving and investment, coupled with the rapid deterioration of utilities and rising defense expenditure have posed serious budgetary problems In addition, debt servicing and shortage of foreign exchange reserves are critical to the economic problems The economic sanctions imposed by the G-7 as a result of the nuclear tests conducted in May 1998 have been further detrimental to inflows of bilateral/multilateral assistance and foreign investment The sanctions have eroded investor confidence and led to a cessation of private capital inflows and suspension of official development assistance, thereby magnifying Pakistan's socio-economic difficulties. However, with the partial waiver of economic sanctions and resumption of lending assistance from international financial institutions, the foreign exchange reserves have increased from $ 415 million in November 1998 to $ 1 84 billion in March 1999 (ADB, 1999)

In order to address the problems of structural and macro-economic imbalances the government initiated a programme of economic reform in 1996/97 The main elements of the reform programme include tariff reduction and rationalization, significant reduction in tax rates and broadening of the tax base, banking sector reforms, downward adjustment of the exchange rate, and accelerated privatization of public enterprises

Progress has been made in reducing the high fiscal and current account deficits, however, with the large quantum of external debt the economy remains vulnerable in the aftermath of the financial crisis in South-East Asia, the weakening market confidence due to poor policy implementation, and law and order problems

The process of economic reform in Bangladesh has been oriented towards increasing privatization and a free market mechanism Even though the present government continues to remain committed to the reform process, the actual progress has been slow due to structural and financial constraints Also given the declining trend in foreign aid, mobilizing more domestic resources to finance public expenditure has become increasingly important. The private sector has a large potential to contribute to the economic growth and the government has been pursuing policies to strengthen the role of the private sector in the country's development efforts. The success of the policy is reflected in the sharp increase in the share of private sector investment in the economy that rose from just under 6% of GDP in 1991/92 to nearly 11% in 1997/98 However, infrastructure deficiencies especially in the port and power sectors are having an adverse effect on the expansion of the private sector activities The private sector has also suffered from the short-comings of the banking sector, the development of the financial institutions and the capital market The government has made some progress in addressing the economy's structural problems and has taken several initiatives to tackle the difficulties of the banking system There however, exists a need to pursue a more flexible exchange rate policy to restore economic competitiveness and maintain macroeconomic stability

In Nepal, dependence on foreign aid has increased in the recent years and accounted for as much as 65% of the total development expenditure in 1998/99 This trend is likely to continue until the government implements major reforms in tax rationalization and public expenditure management The government needs to assign a high priority to tackling structural inefficiencies, including separating politics from bureaucracy, privatizing state-owned enterprises, enhancing accountability and ownership, and initiating institutional development To reduce over dependency on foreign assistance for meeting the country's development needs, continuous effort is required for mobilizing funds, through liberalization and rationalization of trade policies.

Despite a modest increase in private investment in infrastructure projects, regional instability following the international sanctions on India and Pakistan has made an adverse impact on investor confidence in Sri Lanka. This was reflected in the net outflow of foreign investor funds worth $ 25 in 1998/99, a stark contrast to the net inflow of $ 13 million in

1997/98 (ADB, 1999). Privatization revenues were also lower than expected because of depressed capital markets in most developing countries. The principal issues that require consolidation for increasing private sector investment are improvement of fiscal deficit, reform of public administration and the financial sector.

## 2.3 Fiscal indicators

The recurrent dilemma in South Asian countries is that while the governments are trying to liberalize the economy, they are not performing the most essential economic role of managing the finances prudently, thus leading to an unstable macro-economic environment. South Asia is living well beyond its means and is spending far more borrowed money than what it can actually retire through future economic growth (Table 2.2).

**Table 2.2 GDP growth rate (% per annum)**

| Country | 1997/98 | 1998/99 | 1999/2000 | 2000/01 |
|---|---|---|---|---|
| Bangladesh | 5.9 | 5.7 | 3.6 | 5.5 |
| Bhutan | 5.4 | 5.6 | 7 - | |
| India | 5 | 5.8 | 5.9 | 6 |
| Maldives | 6.2 | 6.8 | 6.4 | 6.4 |
| Nepal | 4 | 1.9 | 2 | 2.7 |
| Pakistan | 1.3 | 5.4 | 3.4 | 4.6 |
| Sri Lanka | 6.4 | 5.3 | 5 | 6.2 |
| South Asia | 4.7 | 5.7 | 5.5 | 5.8 |

*Source* ADB, 1999

Such borrowing is the cause for the growing debt burden and an increasingly captive influence on the banking sector. The banking sector, in many South Asian countries has been captivated by the financial demands of the state. Banks have been used for monetizing deficits and bearing the inefficiencies of the state owned enterprises. Domestic financing of budget deficits has been quite large in the range of 4.5%-5.5% of GDP.

Fiscal discipline has in fact declined over the last two decades leading to burgeoning debt liabilities, declining real exchange rates and rising interest rates. Budget deficits have constantly remained in the range of 5%-8% of the GDP in the last decade. While countries like India, Pakistan and Bangladesh have been able to reduce this to about 6%, the figure in Sri Lanka still hovers around 8% of the GDP (Table 2.3).

**Table 2.3 Budget deficit in 1997/98 (as % of GDP)**

| Country | Budget deficit |
|---|---|
| Bangladesh | 5.6 |
| Bhutan | 2.4 |
| India | 5.5 |
| Maldives | 4.9 |
| Nepal | 5.1 |
| Pakistan | 6.2 |
| Sri Lanka | 7.9 |

*Source* ADB, 1999

South Asia has fast accumulated a large stock of public debt, which is being used more often for reducing deficits rather than for enhancing development. In some countries such as Pakistan, India, Maldives, Nepal and Sri Lanka, the public debt as a percentage of GDP has already exceeded 60% (Table 2.4). Most countries of the region rely on external resources for financing their budget deficit, as a result of which there has been an increase in the external debt as a percentage of the GDP (Table 2.5)

**Table 2.4 Total public debt in 1997/98 (as % of GDP)**

| Country | Total public debt |
|---|---|
| Bangladesh | 55 |
| Bhutan | 45 |
| India | 62 |
| Maldives | 60 |
| Nepal | 64 |
| Pakistan | 91 |
| Sri Lanka | 85 |

*Source* World Bank, 1999

The significant increase in internal and external debt, has greatly increased the debt servicing obligations, and interest payments have become the single largest expenditure in the central government budget in the case of India and Pakistan. Debt servicing consumes 32.5% and 38% of the export earnings in India and Pakistan, respectively (Table 2.6). The situation in Pakistan is in fact particularly grim with debt servicing growing at the rate of 6.7% per annum in the period 1993-97. Much of the rise in interest payments arises from the increasing reliance on costly short-term debt. Though this is true for both India and Pakistan, the short-term debt in Pakistan has increased by 100% during the last five years.

**Table 2.5 A profile of public debt in 1997/98 (as % of GDP)**

| Country | External debt | Internal debt |
|---|---|---|
| Bangladesh | 37 | 12 |
| India | 11 | 50 |
| Nepal | 52 | 18 |
| Pakistan | 50 | 41 |
| Sri Lanka | 47 | 47 |

*Source* World Bank, 1999

**Table 2.6 Debt-service ratio in 1997/98 (as % of exports)**

| Country | Debt-service ratio |
|---|---|
| Bangladesh | 11.4 |
| Bhutan | 10.1 |
| India | 32.5 |
| Maldives | 6.8 |
| Nepal | 7.3 |
| Pakistan | 38 |
| Sri Lanka | 13.4 |

*Source* ADB, 1999

An average of 29.4% of GDP as public expenditure cannot be regarded as outrageously high (Table 2.7). The more formidable challenge however is the use that these resources are put to. Unfortunately, a large share of the public expenditure is spent on defense, debt servicing, inefficient subsidies and support for loss-making enterprises.

**Table 2.7 Total public expenditure in 1997/98 (as % of GDP)**

| Country | Total public expenditure |
|---|---|
| Bangladesh | 14 |
| Bhutan | – |
| India | 33 |
| Maldives | 51 |
| Nepal | 19 |
| Pakistan | 21 |
| Sri Lanka | 26 |
| South Asia | 29.4 |

*Source* World Bank, 1999

Inequitable and inefficient resource mobilization and allocation are the major factors contributing to the large fiscal deficit in the countries of the region. One of the prime objectives of a tax policy is to enable efficient resource mobilization- a critical condition for investment and economic growth. Tax collection however remains weak and inadequate and the tax to GDP ratios representing the ability to tap resources from developing economies remains low. On an average the tax revenue as a percentage of the GDP is only 11%, which is lower than the developing country average of 15% and the average of 24% for developed countries (Table 2 8). The tax ratios have also stagnated, or declined thereby indicative of a tax structure that is inelastic and non-responsive to economic growth Furthermore the proportion of direct taxes in the total revenues from taxation is only 29%

**Table 2.8 Tax revenue in 1997/98 (as % of GDP)**

| Country | Tax revenue |
|---|---:|
| Bangladesh | 9 |
| Bhutan | 7 |
| India | 9 8 |
| Maldives | 18 |
| Nepal | 8 |
| Pakistan | 11 5 |
| Sri Lanka | 16 |

*Source* World Bank, 1999

## 2.4 Trade policy: core concerns

International trade and open economies are vital for the growth of South Asian economies The World Trade Organization's (WTO) current agreements are the result of the 1986-94 Uruguay Round of GATT negotiations, which called for a major reform of world trade policies and a substantial reduction in trade barriers, many countries however expect further improvements in the international trading system

In the context of multilateral trading systems, a growth in protectionist tendencies through non-tariff barriers, and a weakening support for trade liberalization and openness by the developed countries, has been observed. Ironically, the level of exports from developing countries declined in the period 1995-99, following the creation of WTO. Even though, the developing countries have remained considerably resolute to trade liberalization and openness, the developed countries have vacillated and engaged in restrictive trade practices. In addition, developing countries have undertaken liberalization measures that entail unemployment and closure of industry, while the industrial countries have taken recourse to antidumping and safeguard measures to protect their employment profile and industry. It is therefore necessary for countries in South Asia to adopt a proactive stance to keep the process of trade liberalization moving forward, through comprehensive, multilateral trade negotiations.

The Third WTO Ministerial Conference held at Seattle in December 1999 was expected to launch fresh negotiations to further liberalize international trade and to review some of the existing trade policies Even though the actual negotiations and work programmes would take place in Geneva, where the WTO is located, a number of issues including the implementation of the results of the Uruguay Round were discussed at the Conference.

Some of the developing countries' concerns pertaining to the implementation of the Uruguay Round include:

- *Intellectual property rights* All developing countries, except the least developed, are required to implement the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement by January 1, 2000 For most developing countries this would imply amendments to the existing legislation or new intellectual property legislation and new means for effective enforcement Developing countries have argued that a period of five years is not adequate for such a radical change and have proposed an extension for the period of transition.
- *Trade-related investment measures* The Trade-Related Investment Measures (TRIMS) Agreement deals with policies that have been regarded as inconsistent with the General Agreement on Trade and Tariffs (GATT). Developing countries are required to introduce measures consistent with the above policy by January 1, 2000 Developing countries have argued that they would like to retain the flexibility to choose investment promotion policies that they consider necessary to fulfil their developmental needs, including those that have been listed as inconsistent with the GATT
- *Sanitary and phytosanitary measures and technical barriers to trade* Sanitary and phytosanitary (SPS) measures deal with animal and plant health and safety, and food safety The Technical Barriers to Trade (TBT) Agreement deals with other technical

standards. According to these agreements member countries are required to take into account the limitations of developing countries while introducing regulations. However, developing countries feel that they have been excluded from the creation of international standards and are often expected to comply with standards that go beyond their technical ability or financial capacity.

*Improved market access for exports* The provision for better market access has not met the expectations for export of agricultural goods and textiles from developing countries In the case of agricultural goods, developing countries have drawn attention to the high tariffs, and tariff escalation on processed goods thereby curtailing processing in exporting countries There is therefore a need for lowering of trade barriers on exports of agricultural goods The WTO Agreement on Textiles and Clothing aims towards integrating trade with the GATT rules over a period of 10 years, thereby phasing-out existing quotas Developing countries have argued that although 33% of the trade has been integrated as committed, only a few quotas have actually been removed Furthermore, the impact of the limited market access that resulted from the implementation of the agreement has been mitigated by the transitional safeguards, anti-dumping measures and discriminatory rules of origin, adopted by the importing countries

### 2.4.1 Trade and labour standards

Currently, labour standards are not subject to WTO rules, however some WTO member governments in Europe and North America believe that the issue must be taken up by the WTO in some form if public confidence in the WTO and the global trading system is to be strengthened These member governments have argued that the freedom to bargain collectively, freedom of association, elimination of discrimination in the workplace and the elimination of workplace abuse (including forced labour and certain types of child labour), are matters for consideration in the WTO. Several member governments have suggested that the issue be brought into the WTO through the formation of a working group to study the issue of trade and core labour standards. Bringing the matter to the WTO, these member governments believe, will provide incentives for WTO member governments to improve conditions for workers around the world. This proposal is currently amongst the most controversial issues before the WTO.

Most developing countries and many developed nations believe that the issue of core labour standards does not belong in the WTO. These member governments see the issue of trade and labour standards as a guise for protectionism in the developed country markets. Developing country officials have said that the efforts to bring labour standards into the WTO represents a smokescreen for undermining the comparative advantage of lower wages in developing countries. In addition, they have argued that better working conditions and improved labour rights arise through economic growth, and therefore if the issue of core labour standards became enforceable under WTO rules, any sanctions imposed against countries with lower labour standards would only perpetuate poverty and delay improvements in workplace standards.

At the first WTO Ministerial Conference in Singapore in December 1996 the issue of trade and labour standards had been addressed in the Ministerial Declaration The Ministers had stated their commitment to the observance of internationally recognized core labour standards as set by the International Labour Organization (ILO). They had rejected the use of labour standards for protectionist purposes, and had agreed that the interests of low-wage developing countries, must in no way be placed at a disadvantage in this regard

Since the Singapore Ministerial Conference, the ILO has taken two significant steps in addressing the issue of workers' rights. In 1998, ILO member governments adopted the ILO Declaration on Fundamental Principles and Rights at Work. These conventions include the freedom of association and recognition of the right to collective bargaining, elimination of all forms of forced labour, the effective abolition of child labour and the elimination of discrimination in hiring and employment practices The ILO member governments have agreed to respect and promote these conventions even though they may not have ratified all of them.

### 2.4.2 Trade and environment

Trade policy and its environmental impact has been a contentious issue amongst the industrialized and developing countries and is an important issue under debate at the WTO

The developing countries view the entwining of environmental standards and trade policies as a constraint to economic growth. The ability of developing countries to implement environmental standards in trade policies is restrained by financial and technical considerations.

The need to comply with externally imposed environmental regulations necessarily entails diversion of scarce funds, which could otherwise be utilized for social and economic growth Besides, the demand for "green" products in the domestic market may not exist. Thus, externally imposed environmental policies could affect product competitiveness and render it unviable for trade All of these factors could get exacerbated if the evolving standards under the various Multilateral Environmental Agreements (MEAs) such as the Convention on International Trade in Endangered Species (CITES), Montreal Protocol etc, vary across countries, making compliance even costlier

Industrial groups in the developed countries however, are lobbying for more stringent environmental standards for its trading partners as they consider it unfair and ecologically unsound to trade with or invest in countries with less stringent environmental standards. Even though there is no inherent conflict between free trade and environmental protection, the question that needs to be addressed is whether trade policy is the appropriate tool to attain environmental protection

Some industrialized countries seek to impose sanctions against trading partners that fail to enforce environmental standards. Developing countries, however, oppose such measures on the basis that a clear distinction needs to be made between local and global environmental pollution and that there is no legitimate case for trade sanctions to combat problems of local pollution In contrast to local pollution, it is however possible, to make a case for international action, including trade measures, to combat global environmental problems Even though trade sanctions are one way to encourage countries to sign environmental agreements, countries in the past have refused to sign an international environmental treaty because their government viewed it as illegitimate, inefficient, or inequitable One of the concerns faced by the economically weak countries is that the politically and economically strong countries may devise treaties that place a large burden on them, and impose trade sanctions on violating the treaty.

Therefore, arguments for using trade policy to correct environmental externalities are weak, and rather inadequate for making amendments in the GATT/WTO rules. Environmental problems are not an outcome of international trade; rather they originate from market failure and the absence of clearly defined property rights and therefore trade policy may not be the best instrument to correct them. In addition, even though, the preamble to the WTO Agreement refers directly to the objective of sustainable development and the need to protect and preserve the environment, the role and expertise of WTO has been so far been restricted to the coordination of policies with significant ramifications for trade, and therefore the task of setting environmental standards or developing global policies on environment ought to be entrusted to the national governments or multilateral organizations better suited for this purpose.

### 2.4.3 The role of regionalism

In the early 1980s, due to reluctance by the European Union (EU) to engage in a new round of multilateral trade negotiations, the United States turned to regionalism as a vehicle for trade liberalization. Economists, however, tend to be skeptical about the benefits from regional trade agreements as they are usually discriminatory, liberalizing trade agreements between member countries but maintaining trade barriers in relation to non-members As a result, imports from less efficient member countries may replace imports from more efficient non-member countries outside the regional trade bloc Regional trade agreements in Asia are limited The ASEAN Free Trade Area and the South Asian Preferential Trade Area (SAPTA) are the only two institutions registered under the WTO Neither institution has promoted a preferential trade policy While members of the ASEAN Free Trade Area have opted for liberalizing trade on a multilateral basis so that the benefits of any tariff reduction that they may undertake extends to non-member countries as well, the SAPTA that came into operation in 1995, has made little impact on the trade policy in South Asia

Regional integration has been regarded as complementary to wider trade liberalization. European amalgamation, for instance has created one of the largest markets in the world, combining the states in Western Europe into a single economic unit of about 320 million people with a combined GDP of $ 6 trillion. In contrast, the South Asian region comprises nearly one-fifth of the global population, with an aggregate GDP of about $ 400 billion in 1995. Therefore, at present, the benefits of economic integration are elusive in the South Asian context Significant efforts are required to increase intra-regional trade, which accounts for as little as 4% of the total trade in South Asia (H, Vernon, 1997). Strategic considerations between India and Pakistan, and the threat of further integration with India in the case of the smaller economies, are amongst the major factors that can be attributed to the reluctance in promoting regional integration.

## References

1. ADB. 1999. *Asian Development Outlook*. New York: Oxford University Press Asian Development Bank.
2. EIA. 1999. *South Asian Regional Review*. United States Energy Information Administration.
3. World Bank 1997 **Private Capital Flows to Developing Countries** Washington.D.C: The International Bank for Reconstruction and Development and The World Bank
4. IMF 1999 *World Economic Outlook* Washington D C International Monetary Fund
5. World Bank. 1999 **Human Development in South Asia** Oxford University Press, Karachi, Pakistan.
6. Hewitt Vernon. 1997. **The New International Politics of South Asia** UK Manchester University Press.

# Chapter 3: Energy demand and supply

## 3.1 Energy-economy indicators

The South Asian region defined as; India, Pakistan, Bangladesh, Sri Lanka, Bhutan, Nepal and the Maldives, is of importance to the world energy market because it contains 1.3 billion people, close to a quarter of the world's population, and is experiencing a rapid growth in energy demand, concomitant with economic growth and industrialization. Providing adequate energy supply is therefore, a major challenge facing these economies, leading to the formulation of policies with increased incentives for energy imports, foreign investments and regional cooperation.

Investment decisions require a comprehensive analysis of fuel-wise demand and supply. This chapter provides simple indicators that reflect the interrelationship between energy consumption and economic growth; and facilitate cross-country comparisons for fuel structure, sectoral energy consumption and self-reliance.

Economic growth in the region averaged 5.3% per annum in the period 1990-97, with India and Pakistan recording the highest growth rate of 5.4% and 4.8% respectively, in the same period (IEA, 1999). The total primary energy supply in South Asia, which is indicative of the total energy consumption increased at the rate of 3.6% in the period 1990-97(Table 3.1). In 1997/98, the total primary energy supply in the region including and excluding renewable energy was 556.5 million tonnes of oil equivalent (mtoe) and 305.8 mtoe respectively, of which India constituted the dominant share accounting for about 88% of the total energy consumption. The Total Primary Energy Supply (TPES) including renewable energy is expected to increase to 1411 mtoe in 2010/11, with biomass accounting for 28% of the total energy consumption.

**Table 3.1 Total primary energy supply (including renewable energy)**

**(Million tonnes of oil equivalent)**

| | 1990/91 | 1997/98 |
|---|---|---|
| Bangladesh | 20.8 | 24.33 |
| India | 359.85 | 461.03 |
| Nepal | 5.83 | 7.16 |
| Pakistan | 43.24 | 56.82 |
| Sri Lanka | 5.48 | 7.16 |
| Total South Asia | 435.2 | 556.5 |

*Source*. IEA, 1999

The energy intensity (taking only commercial energy into account) in the region improved from 1.21 tonnes of oil equivalent per thousand $ (toe /'000 $) in 1990/91 to 0.99 (toe/'000 $) in 1997/98, though it still remained higher than the world average of 0.37 toe/'000 $. The decline in energy intensity can be attributed to structural changes in the economy as well as improvement in energy-efficiency. Price rationalization and deregulation of the energy sector are expected to further increase energy efficiency and hence lower the energy intensity in the region. Energy intensity in India and Nepal has been consistently higher than the regional average (Figure 3.1).

**Figure 3.1 Energy intensity**

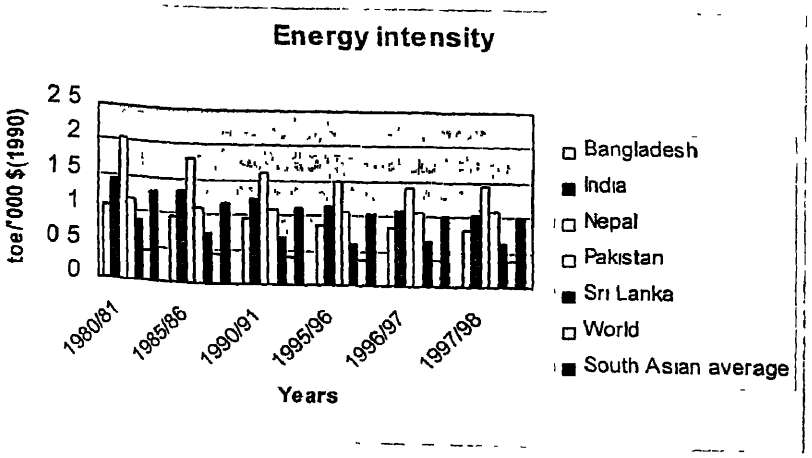
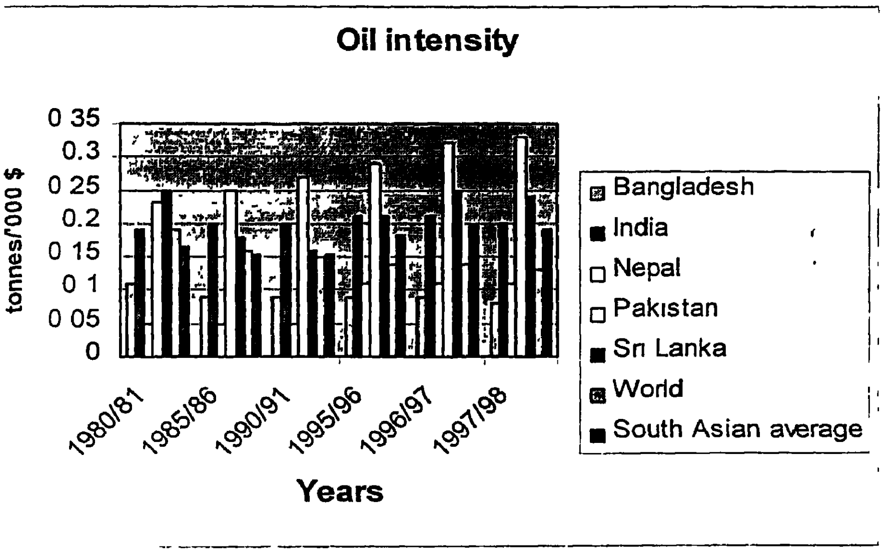


**Figure 3.2 Oil intensity**



Source IEA, 1999

While the average oil intensity in the world has declined from 0.19 toe/'000US $ in 1990/91 to 0.13 toe/'000 $ in 1997/98, oil intensity in the region has increased from 0.17toe/'000 $ in 1990/91 to 0.19 toe/'000 $ in the same period. Oil intensity in Pakistan and Sri Lanka at 0.33 toe/'000 $ and 0.24 toe/'000 $, respectively, far exceeds the regional average (Figure 3.2).

Despite the rapid growth in energy demand, the region averages the lowest per capita energy consumption in the world (Figure 3.3). This can be attributed to a high population growth rate of 2.2% compared to the world population growth rate of 1.6% in the period 1990-97 (IEA, 1997). In 1997/98, the average per capita energy consumption was 0.37toe/person compared to the world average of 1.7 toe/person. Even though the regional average has improved in the recent years, it has remained far below the world average. In Bangladesh and Nepal, the per capita energy consumption continues to remain far below the regional average. A similar trend is observed in the case of per capita oil consumption, with a regional average of 0.08 toe/person compared to the world average of 0.60 toe/person in 1997/98 (Figure 3.4). The regional per capita electricity consumption of 219 kWh/person was also far below the world average of 2258 kWh/person in 1997/98, illustrating the need for large scale rural and urban electrification (Figure 3.5).

**Figure 3.3 Per capita energy consumption**

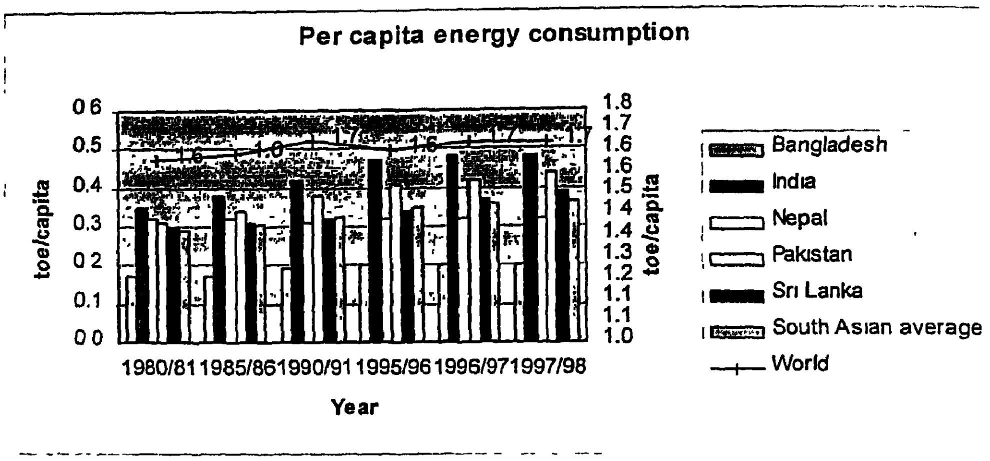


**Figure 3.4 Per capita oil consumption**

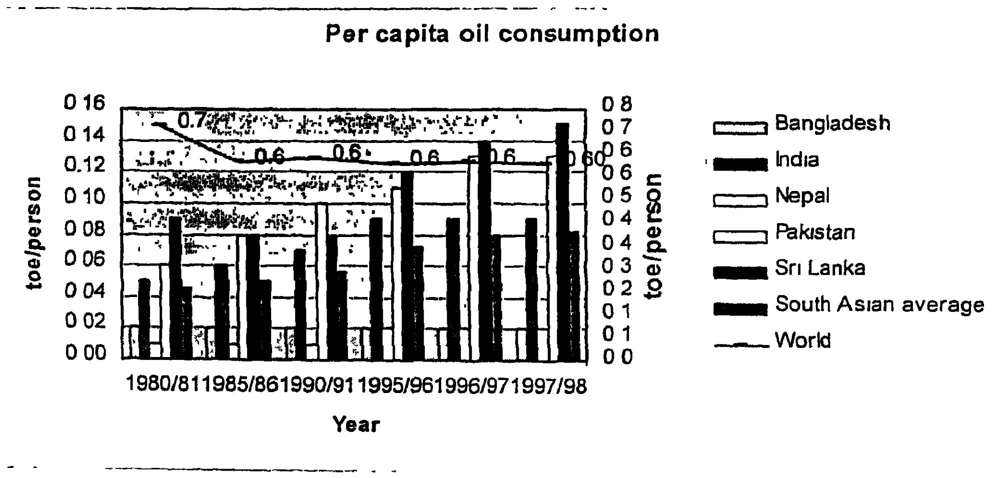
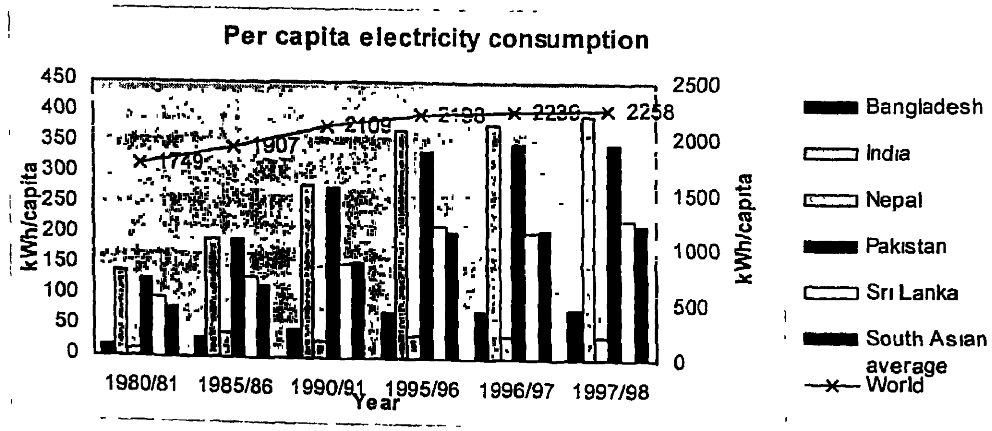


**Figure 3.5 Per capita electricity consumption**



Source IEA, 1999

## 3.2 Energy demand

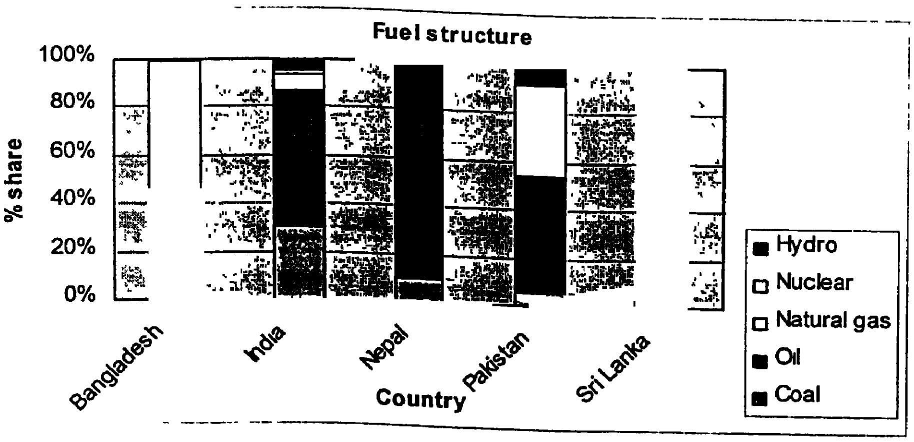
### *3.2.1 Fuel structure*

There exists, a significant variation in the fuel structure, amongst the countries of the region (Figure 3 6) Coal constitutes as much as 30% of the total commercial energy requirement in India In Bangladesh, oil and natural gas are the dominant fuels and comprise 53% and 47% of the total energy consumption Similarly, in Pakistan, oil constitutes 46% and natural gas 38% of the total energy consumption Sri Lanka is largely dependent on oil (87%), and Nepal has a large share of imported oil and hydroelectricity in the energy mix.

The significant change in the fuel structure in the recent years has been an increase in the share of natural gas, owing to the important gas discoveries made in India, Pakistan and Bangladesh as well as environmental considerations arising from the large quantities of coal consumed in the region Natural gas has been used largely as a feedstock in the fertilizer and petrochemical sectors, with marginal consumption as a fuel in the power generation sector, however this trend is likely to change in the future (IEA,1998) At present, gas accounts for only about 8% of the total energy consumption in India, while in Bangladesh, it is the main source of energy

The shares of nuclear energy and hydro electricity have remained small, though not unimportant, and largely unchanged in the recent years. Though there has been a decline in the share of renewable energy in the total energy consumption, it constitutes as much as 90% of the total energy mix in Nepal, and ranges from 42% in India to 66% in Bangladesh

**Figure 3.6 Fuel structure for commercial energy 1997/98 (mtoe)**



### 3.2.2 *Sectoral energy consumption*

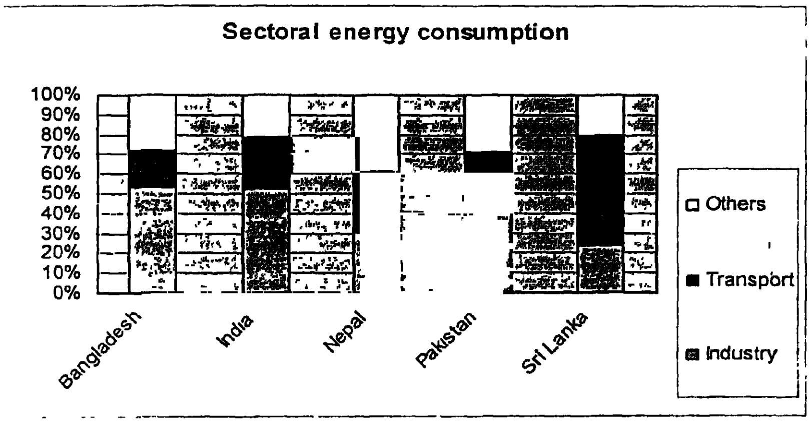
Taking only commercial energy into account, the industrial sector consumes the bulk of the energy followed by the transport sector (Figure 3.7) India accounts for about 86% of the total industrial energy consumption in the region In India, coal constitutes a major share of the energy consumed in the industry and power generation sectors. However the share of coal in these sectors is likely to decline due to substitution by oil and natural gas.

Economic reforms undertaken by the countries of the region will have an important impact on the pace and structure of industrial growth. The industrial sector in India is expected to lead the process of economic development and its growth rate is expected to increase in the future Energy demand would be moderated to the extent that structural changes favour the growth of less energy intensive industries. In addition, with the growth in international trade and liberalization, the countries of the region are likely to pursue their comparative advantage in labour intensive manufacturing industry (IEA, 1998).

Energy demand in the transport sector is strongly correlated to economic growth The two other factors that influence the energy consumption in the sector are the relative shares of road and rail, and the fuel mix The fuel pricing policy has so far encouraged the use of diesel in the road transportation sector, which combined with the higher rail freights has encouraged a shift from rail to road A rapid increase in oil demand for the transport sector would imply a higher import dependence and raise concerns about the security of supply

Renewable energy constitutes a large share of the total energy consumed in the domestic sector, however, since the efficiency of non-commercial fuels is low, the useful energy they provide is also low Urbanization and income-levels have been the major determinants of the choice of fuel in the domestic sector, and have led to a switch from non-commercial fuels to commercial fuels

**Figure 3.7 Sectoral energy consumption**

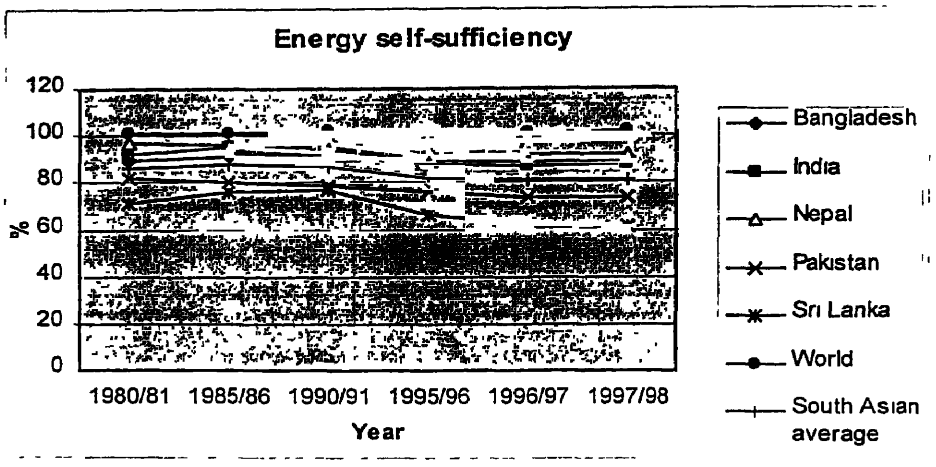


*Source* IEA, 1999

## 3.3 Energy supply

Figure illustrates the self-sufficiency in energy which is expressed as energy production as a percentage of the total primary energy supply Self-sufficiency in the region declined from 86% in 1990/91 to 81% inn 1997/98, and this trend is likely to continue in the future in light of the increase in energy demand thereby necessitating larger import volumes. There is therefore an urgency to enhance indigenous energy supply, through greater exploration, production, refining and development of transport infrastructure Due to the large variation in the energy resources within the region there also exists a significant potential for integrating the energy markets in the region which has been discussed in some detail later in the report

**Figure 3.8 Energy self-sufficiency**



*Source.* IEA, 1999

### 3.3.1 Coal

Almost all the coal is produced and consumed in India (Table 3 2), the only country in South Asia with significant coal reserves (proven coal reserves estimated at 79 billion tonne (bt) as on 1 1 99) and the world's third largest coal producer Currently, coal constitutes as much as 33% of the total primary energy supply in India and constitutes a small share (4% in 1996/97) in Pakistan's total energy supply However, with the large discovery of low ash, low sulphur lignite in the Sindh Province, the share of coal in Pakistan's fuel structure may increase Bangladesh and Sri Lanka have insignificant coal reserves and consume almost no coal (Table 3 3)

Through a sustained programme of investment and greater thrust on application of modern technologies, coal production in India increased to 294 mt in 1998/99 as compared to 209 mt in 1990/91 In order to meet the country's growing demand for coal, collaboration with advanced coal-producing countries is being sought in terms of·

- introducing new technologies in both underground and opencast mining,
- bilateral funds for equipment import, and
- increasing investment through foreign financial assistance

**Table 3.2 Coal production (Million tonne)**

| Country | 1990/91 | 1997/98 |
|---|---|---|
| India | 208 6 | 294 5 |
| Pakistan | 2.5 | 2.8 |
| Total South Asia | 211.0 | 297 3 |

*Source* IEA, 1999

**Table 3.3 Coal imports (Million tonne)**

| Country | 1990/91 | 1997/98 |
|---|---|---|
| Bangladesh | 0 56 | 0 |
| India | 6 7 | 11 6 |
| Nepal | 0 02 | 0 1 |
| Pakistan | 1 2 | 1 3 |
| Total South Asia | 8 5 | 13 0 |

*Source* IEA, 1999

### *3.3.2 Oil*

South Asia accounts for less than 0 5% of the world's crude oil reserves and produced 40.5 million tonnes in 1997/89 India's recoverable reserves of crude oil and natural gas have declined continuously after peaking at 806 mt and 735bcm respectively, in the year 1991/92 (TERI, 1999). The current balance recoverable reserves for crude oil and natural gas in India are estimated at 726 mt and 692 billion cubic meter (bcm), respectively Of the 26 sedimentary basins in India, only 6 have been explored so far, accounting for only 30% of the country's prognosticated reserves India therefore continues to be one of the least explored regions of the world with a well density of 20 per 10000 square kilometres as against a world average of 100 Elsewhere in the region, crude oil and gas reserves are estimated at 28 mt and 507bcm, respectively, in Pakistan, and oil and gas reserves are estimated at 0 74 mt and 311 bcm, respectively, in Bangladesh (EIA, 1999)

Most of the crude oil production in South Asia is accounted for by India which produced 38 mt in 1997/98, or 93% of the total oil production in the region while Pakistan produced 3 mt in the same year (Table 3 4) The current refining capacity in India is 68 5 mt/year and about 50 mt/year of refining capacity is under various stages of development In Pakistan the current refining capacity is 6 9 mt/year and this is expected to increase to 11mt/year by the year 2000/01. At present, Bangladesh has one refinery with a capacity of 1 6 mt/year, and Sri Lanka has a refining capacity of 2 4 mt/year.

India is also the largest consumer and importer of crude oil and petroleum products as is evident from Table 3.5. Petroleum product consumption has grown at the rate of about 6.7% in the region, with Nepal and Sri Lanka, recording the highest growth rates of 18.9% and 9.8%, respectively, in the period 1990-96 (Table 3.5). This trend is likely to continue in the future due to increased demand for oil as a transportation fuel and new oil-fired power plants, to reduce a near total dependency on hydro power in the case of Sri Lanka.

**Table 3.4 Crude oil production (million tonnes)**

| | 1990/91 | 1997/98 |
|---|---|---|
| Bangladesh | 0.11 | 0.01 |
| India | 35.56 | 37.59 |
| Pakistan | 2.72 | 2.92 |
| Total South Asia | 38.39 | 40.52 |

*Source* IEA, 1999

**Table 3.5 Petroleum product consumption (million tonnes)**

| | 1990/91 | 1997/98 | Growth rate(%) |
|---|---|---|---|
| Bangladesh | 1.63 | 2.54 | 6.54 |
| India | 51.86 | 79.87 | 6.36 |
| Nepal | 0.19 | 0.52 | 15.46 |
| Pakistan | 8.16 | 11.29 | 4.74 |
| Sri Lanka | 1.18 | 2.04 | 8.13 |
| Total | 63.02 | 96.26 | 6.23 |

*Source* IEA, 1999

Oil imports have increased at the rate of 9.2% in the period 1990-97. Most of the crude oil imports are sourced from the Middle east, and this trend is likely to continue leading to energy security concerns that have been discussed in this report.

**Table 3.6 Net oil imports (million tonnes)**

| | 1990/91 | 1997/98 |
|---|---|---|
| Bangladesh | 1.93 | 2.44 |
| India | 26.15 | 50.87 |
| Nepal | 0.2 | 0.52 |
| Pakistan | 8.42 | 14.24 |
| Sri Lanka | 1.66 | 3.08 |
| Total | 38.36 | 71.15 |

*Source* IEA, 1999

### 3.3.3 *Natural gas*

South Asia contains about 1.44 trillion cubic meter (tcm) or about 1% of the total gas reserves in the world. Even though the current gas reserves in Bangladesh are estimated at a modest 311 bcm, some foreign oil companies believe that the actual reserves may be much higher, thereby, allowing for significant gas exports from Bangladesh to India and Pakistan.

Of the total gas produced 48% is accounted for by India, 36% by Pakistan and 16% by Bangladesh (Table 3.7). The countries of the region have so far been self-reliant in natural gas, however with the demand for natural gas projected to increase to 77bcm by the year 2010/11(IEA, 1998), an increase in production and imports would be required. The advancements in gas utilization technologies as well as environmental concerns have contributed to the growth in gas demand in the region. Several options are being explored for importing natural gas in the form of liquified natural gas (LNG) or through pipelines from the Middle East and the Caspian region. However, the main obstacle for importing gas is the lack of adequate infrastructure, in addition to geopolitical constraints.

**Table 3.7 Natural gas production (billion cubic metre)**

| Country | 1990/91 | 1997/98 |
|---|---|---|
| Bangladesh | 4.2 | 6.4 |
| India | 11.8 | 19.8 |
| Pakistan | 11.8 | 14.9 |
| Total | 27.8 | 41.1 |

*Source*: IEA, 1999

### 3.3.4 *Renewable energy*

One of the most important elements of sustainable development pertains to the protection of the environment by reducing carbon dioxide ($CO_2$) emissions and local pollutants and preserving the natural resource base which has deteriorated considerably due to the rapid growth in population, urbanization, and fossil fuel consumption.

The development and promotion of appropriate technologies using renewable natural resources such as biomass, water, wind, and solar energy is therefore critical for the conservation of the natural resource base. Renewable energy technologies (RETs) have a large potential in South Asia and have the advantage of being environmentally sustainable. Table 3.8 illustrates the potential for renewable energy technologies in the case of India.

Table 3.8 Potential for renewable energy technologies in India

| Source/System | Approximate potential |
|---|---|
| Biogas plants | 12 million |
| Improved woodstoves | 120 million |
| Biomass | 17000 MW |
| Solar energy | 20MW/km2 |
| Wind energy | 20000 MW |
| Small hydro power | 10000MW |
| Ocean energy | 50000MW |
| Energy from urban, municipal and industrial wastes | 1700MW |

*Source* MNES, 1999

As can be seen in Table 3.8, there exists a significant potential for power generation from renewable energy sources. Power generation from renewable energy sources mainly wind and biomass, in South Asia is expected to increase from 0 1 terawatt hours (TWh) in 1996/97 to 12 4TWh in 2010/11 (IEA, 1998).

In 1997/98, renewable energy, mostly in the form of biomass constituted about 45% of the total energy supply in South Asia (Table 3 9). Biomass meets a large part of the energy requirements in the rural areas However, since biomass is burnt directly, through low efficiency equipment the useful energy produced is quite low.

Table 3.9 Renewable energy supply (Million tonnes of oil equivalent)

| | 1990/91 | 1997/98 |
|---|---|---|
| Bangladesh | 13.4 | 16 0 |
| India | 162.3 | 192 8 |
| Nepal | 5.0 | 6.5 |
| Pakistan | 16.2 | 22 4 |
| Sri Lanka | 3.6 | 4 1 |
| Total | 200.5 | 241 7 |

*Source.* IEA, 1999

### 3.3.5 Power

The total power generation in South Asia in 1997/98 was 541TWh, of which about 61% was coal-based, 19% was from hydroelectric plants, 10% from natural gas, 7% from oil, 2% from nuclear and less than 1% from renewable energy sources (Table 3 10). The share of natural gas is likely to increase in the future due to environmental concerns, coal-based power generation and the infrastructure bottlenecks for coal transportation. In India, the total installed capacity in 1997/98 was 89 GW, which increased to 91GW in 1998/99, of which 73% is thermal, 24% is hydel and 3% is nuclear based capacity The total power generated was 463 TWh in 1997/98 which was about 30% below the demand, thereby necessitating hydro power imports from Nepal and Bhutan (Table 3 11 and 3 12)

In Pakistan, of the total installed capacity of 14 6 GW in 1997/98 and increased to 15.5 GW in 1998/99 Hydroelectric plants accounted for about 31% of the total generating capacity followed by 67% of thermal oil-fired and gas fired plants and 2% of nuclear power generation Significant foreign investment is required to add new gas-fired and hydroelectric capacity to meet the growth in power demand Recent capacity additions in Pakistan can be attributed primarily to the Independent Power Producers (IPPs), more details on which are provided in the subsequent chapters

In Bangladesh, the total installed capacity was 2 5 GW in 1997/98, which increased to 2 9 GW in 1998/99 Of the total installed capacity 93% is thermal (mainly natural gas fired) and the remainder is hydroelectric Overall the country's power generation has been unable to meet the growth in demand, with only 14% of the population connected to the grid. In addition, about 30%-40% of the generating stations may have to be retired. The government has therefore invited proposals from foreign investors for setting up IPPs In 1998, the government also adopted a 'Small Power Generation Policy' and launched a large-scale rural electrification programme

**Table 3.10 Power generation (terawatt hours)**

| Country | 1990/91 | 1997/98 |
|---|---|---|
| Bangladesh | 7 7 | 12 |
| India | 289 4 | 463 |
| Nepal | 0 7 | 1 |
| Pakistan | 37 7 | 59 |
| Sri Lanka | 3 2 | 5 |
| Total | 338 7 | 541 |

*Source* IEA, 1999

**Table 3.11 Power imports (gigawatt hours)**

| Country | 1990/91 | 1997/98 |
|---|---|---|
| India | 1440 | 1547 |

*Source* IEA, 1999

**Table 3.12 Power exports (gigawatt hours)**

| Country | 1990/91 | 1997/98 |
|---|---|---|
| Nepal | 23 | 23 |
| Bhutan | - | 1400 |

*Source*. IEA, 1999

References.

1 IEA 1999 *Energy Statistics and Balances of Non-OECD Countries*. International Energy Agency Paris

2 MNES 1999 *Annual Report 1998/99.* Ministry of Non-conventional Energy Sources, Government of India

3 TERI 1999 TEDDY (TERI Energy Data Directory and Yearbook) New Delhi Tata Energy Research Institute

4 IEA 1998 *World Energy Outlook* International Energy Agency. Paris

5 EIA 1999 *Country Analysis Brief* Energy Information Administration United States Department of Energy

# Chapter 4: Energy outlook

## 4.1 Coal

In India, the demand projections for coal made by the Planning Commission, Government of India are based on the end-use analysis of power, cement, and iron and steel sectors, assuming a GDP growth rate of 7.4% in the period 1997-2012 (Planning Commission 1998). The annual average demand growth rate for coal projected for the period 1997-2012 is 6.8% (Table 4.1). The domestic supply will be coming from existing mines as well as new projects requiring significant investments.

**Table 4.1 Coal demand and supply forecasts for India (Million tonne)**

| | 1997/98 | 2001/02 | 2006/07 | 2011/12 |
|---|---|---|---|---|
| Demand | 323 | 400 | 576 | 872 |
| Domestic supply | 298 | 360 | 484 | 652 |
| Deficit | 25 | 40 | 92 | 220 |

*Source*: Planning Commission (1998)

Underground mining has not been exploited adequately due to technological constraints. Hence, coal production from opencast mining is expected to constitute nearly 73% of the total coal produced in the year 2001/02. The over-exploitation of shallow reserves of coal by opencast mining may result in almost total dependence on underground production in the longer term. Hence a proper balance needs to be created in the underground–opencast technology mix.

A demand and supply gap of 40 mt has been estimated by the year 2002. This gap is expected to fill through increased imports of coking and non-coking coal. This is largely a result of the liberalization policy providing access to imported coal at a lower import duty. Moreover, since coal is traded in US dollars internationally, the recent currency devaluation against the US dollar has enabled countries such as Australia and South Africa to lower coal prices substantially while continuing to receive the same or higher price in local currency. Coal imports have consequently increased as they have become more economical compared to indigenous coal at some locations, especially along the coastline. Australia has become the largest coal exporter in the world, as it supplies bulk of the imported non-coking coal in Asia and is expected to meet almost 50% of the total imports in South Asia by the year 2010/11 (Table 4.2).

The demand for coal is expected to increase to 576 mt by the year 2006/07, this would be largely on account of planned addition of 116 gigawatt (GW) of coal-based power generation capacity during the Tenth Five Year Plan (2002-2006). The power sector being the largest consumer of non-coking coal constitutes about 87% of the total coal demand. In addition, the Ministry of Industry has projected a growth rate of 8% in cement demand for the Tenth Plan period, thus implying an increased coal demand In the longer term, the deficits in supply of indigenous coal will lead to a switch to cleaner alternative fuels such as natural gas in the power sector.

At the end of the Eleventh Plan period (2006/7-2011/12), the demand for coal expected to increase to 872 mt Some of the factors that are likely to impact the availability and demand for indigenous coal in the future are outlined below

- *Infrastructure bottlenecks* The constraints on railway capacity and network, and port handling facilities, need to be considered in arriving at a realistic demand for coal The coal-based plants in the coastal locations, for instance, may find it more economical to use imported coal due to the long distances over which the domestic coal has to be transported.
- *Pricing policies* The deregulation of prices for indigenous coal and reduction of duty on imported coal, will facilitate a switch to imported coal especially at certain locations in southern and western regions
- *Environmental impacts of coal mining and utilization* The poor quality of coal coupled with stricter environmental norms will lead to a switch to cleaner fuels such as natural gas In addition, environmental problems such as deforestation and rehabilitation associated with mining projects have also slowed down the development of new mines

**Table 4.2 Direction of coal imports for South Asia–2010/11 (Million tonne)**

| | N America | Australia | Central and Eastern Europe | South Africa | East Asia | South and Central America |
|---|---|---|---|---|---|---|
| Imports | 1 | 33.4 | 0.5 | 10.2 | 4.4 | 13.4 |

*Source* IEA, 1999

## 4.2 Oil

The demand for oil is estimated to grow at the rate of 4.2% in the period 1996-2010 (IEA, 1998) The oil demand forecasts assume an economic growth rate of 3.1% and a crude oil price of US$ 17/b in the forecast period. Most of the increase in oil demand is accounted for by the growth in the transport sector and oil-fired power generation capacity addition. While oil production is expected to remain stagnant at 0.8 mb/d, demand is expected to increase at the rate of 4.2% and imports are expected to increase at the rate of 3% in the period 1996-2010 (Table 4.3). The forecasts for oil supply have been made using a Hubbert Curve that establishes a relationship between the oil resources and production levels, assuming that the oil resources would increase due to an improvement in technology.

Oil demand in Pakistan is expected to increase at the rate of 7% per year and reach 0.58 mb/d, while the supply would be only 0.2 mb/d by the year 2005.

**Table 4.3 Crude oil demand and supply in South Asia (mb/d)**

| | 1996/97 | 2010/11 |
|---|---|---|
| Power generation | 0.14 | 0.28 |
| Transport | 0.93 | 1.85 |
| Industry | 0.82 | 1.53 |
| Total demand* | 2.3 | 4.1 |
| Production | 0.8 | 0.8 |
| Imports | 1.5 | 3.3 |

*includes bunkers

*Source* IEA, 1998

In the case of India, the product demand estimates for the year 2001/02 have been made by the Planning Commission, Government of India based on end-use analysis and by correlating the consumption of petroleum products to the growth in GDP. The demand for petroleum products is estimated to grow at a Compound Annual Rate of Growth (CARG) of 6% in the period 1997-2012 and is expected to reach 4.06 mb/d in the year 2011/12 (Table 4.4).

**Table 4.4 Oil demand and supply in India (Million barrels per day)**

| Year | Crude production | Crude imports | Petroleum products demand | Self reliance (%) |
|---|---|---|---|---|
| 1997/98 | 0.69 | 0.62 | 1.68 | 39 |
| 2001/02 | 0.74 | 1.57 | 2.1 | 33 |
| 2006/07 | 0.8 | 2.2 | 2.89 | 26 |
| 2011/12 | 0.9 | 3.31 | 4.06 | 21 |

*Source* Planning Commission (1998)

Due to the large quantum of demand, the percentage self-reliance is expected to decline from 39% in 1997/98 to 21% by the year 2011/12. The import dependence could however be reduced by adopting the following strategy:

- accelerated exploration, especially offshore, with improved reservoir management;
- rationalization of oil prices,
- acquisition of acreage and equity oil in other countries; and
- creation of adequate refining capacity, which has been achieved to a large extent already In this respect the planned capacity additions in refining which would increase the capacity from 2 62 mb/d in 2002 to 3 55m b/d in 2007, would contribute in reducing the petroleum product imports, even though the imports for crude would continue to increase unless domestic production is increased.

## 4.3 Natural gas

A significant increase in the demand for natural gas is estimated in the period 1996-2010 (Table 4 5), largely due to environmental concerns, and for reducing expensive oil imports The high efficiency of the Combined Cycle Gas Turbines along with the low emissions of $CO_2$ and $SO_2$ make it particularly attractive for power generation With the development in technology, the gas production is expected to increase In the case of Bangladesh for example, large gas reserves are known to exist but due to lack of adequate seismic data and infrastructure constraints, production is considered uneconomical Therefore, to meet the growth in demand, the countries of the region would need to increase domestic production, and import natural gas as LNG or piped gas As gas prices increase, exploitation of unconventional gas resources, may also become more economical A more detailed discussion on the prospects for importing natural gas from the Caspian region and the Persian Gulf has been provided in chapter 9

The IEA's projections for gas demand and supply are provided in Table 4 5 The gas supply projections are based on a simple Hubbert's Curve that establishes a relationship between the cumulative gas production and the estimated reserves In order to allow for an increase in the gas reserves, a growth in production is allowed until 60% of the ultimate conventional gas reserves as provided by the United States Geological Survey have been used Once the threshold is reached a decline in production at the rate of 5% per annum has been assumed

**Table 4.5 Demand and supply of natural gas in South Asia (billion cubic metre)**

| | 1996/97 | 2010/11 |
|---|---|---|
| Power generation | 13 11 | 29.33 |
| Stationary sectors* | 21 | 60 89 |
| Total demand | 34.11 | 90.22 |
| Supply | 42.27 | 113 27 |

*Source* IEA, 1998

* Stationary sectors include industry, residential, commercial, agricultural and other energy uses

The gas demand and supply projections for India are provided in Table 4 6 At present about 80% of the gas is consumed by the power and fertilizer sectors, 10% by the sponge iron units and 10% by the industry where it replaces FO and LPG The future demand for natural gas is dependent on structural changes in the economy, growth in industrial sector, energy pricing and tariffs, energy conservation measures and policies to reduce environmental damage

The increase in gas demand can be attributed to the planned capacity addition in the power, fertilizer, and industrial sectors, supply constraints on primary energy sources, and environmental advantages of natural gas However, the effective gas demand may be significantly lower than the projected values

In order to enhance supplies in the longer term, LNG imports as well as unconventional gas resources like coal-bed methane, exploitation of gas hydrates, *in-situ* coal gasification, etc , are being considered The gas demand for the fertilizer sector assumes that the entire fertilizer demand is met through domestic production except for 2mtpa of urea that is imported (same as existing level of imports) Moreover it has been assumed that all the urea is produced using gas, and the future conversion of existing naphtha-based plants would increase the gas demand in the future Some reports however project a lower gas demand based on the premise that importing fertilizer is more economical Also in case of fertilizer plants located at inland locations, it may be more economical to use naphtha sourced from refineries considering the high distance and volume related tariff for gas pipelines, which may render the gas transportation over long distances uneconomical.

In the short term, no fresh gas commitments are being made due to constraints on supply and, therefore, the allocation for natural gas remains constant in the latter part of the Ninth Plan In the period 1997-2002, gas would be available from the oil and gas fields of the ONGC (Oil and

Natural Gas Commission) and OIL (Oil India Limited). In addition, gas imports in the form of piped gas/LNG (liquefied natural gas) are being considered.

**Table 4.6 Natural gas demand and supply in India (Million cubic metres per day)**

| | 1996/97 | 2001/02 | 2006/07 | 2011/12 |
|---|---|---|---|---|
| Demand | 52.1 | 117.8 | 167.1 | 216.4 |
| Production | 49.3 | 71.2 | 57.5 | 43.8 |
| Gap | 2.8 | 46.6 | 109.6 | 172.6 |

Source. Planning Commission, 1998

## 4.4 Power

The IEA has projected the power generating capacity to increase from 106 GW to 212 GW in the period 1996-2010 (Table 4.7). Also about 13 GW of capacity is expected to retire in this period. The projections for power generation capacity are based on the demand projections for power and the assumptions on fuel prices and their availability, including infrastructure constraints as in the case of transportation of natural gas. Capital and operating costs for the different types of generating plants have also been taken into account to minimize costs.

The share of gas-based generation is expected to increase from 11% in 1996/97 to 12% in 2010/11 as these plants have low capital costs and a shorter gestation period (Table 4.8). The share of coal based generation would remain unchanged, largely due to the close proximity to the abundant reserves as in the case of India. The share of oil based generation, however, is expected to decline from 7.5% to 5.6% in the period 1996-2010. The share of hydro-power generation is also expected to decline from 19% in 1996/97 to 17% in 2010/11. Even though power generation from renewable energy sources is expected to increase significantly, it would continue to constitute a very small share (0.74%) in the total generation mix.

**Table 4.7 Fuel-wise installed capacity in South Asia (GW)**

| | 1996/97 | 2010/11 |
|---|---|---|
| Thermal | 77.9 | 158.4 |
| Hydro | 26 | 46 |
| Nuclear | 2 | 3 |
| Renewables | 0.1 | 4.6 |
| Installed capacity | 106 | 212 |

*Source* IEA, 1998

**Table 4.8 Fuel-wise power generation in South Asia (TWh)**

| | 1996/97 | 2010/11 |
|---|---|---|
| Coal | 310 | 661 |
| Oil | 38 | 60 |
| Gas | 56 | 126 |
| Nuclear | 9 | 15 |
| Hydro | 97 | 200 |
| Renewables | 0 057 | 8 |
| Total | 509 94 | 1070 |

*Source* IEA, 1998

The Fifteenth EPS (Electric Power Survey) projects power demand in India for two time horizons, the short-term forecasts up to 2001/02 and long-term forecasts up to 2011/12 (MoP 1995) The short-term forecast is based on a detailed analysis of the consuming sectors, inter alia taking into account the production targets indicated for each industry, the trends in consumption pattern, etc , and making due allowances for restrictions in power supply experienced in the past (Table 4 9)

The long-term forecast up to 2011/12 is made by extrapolating the overall power demand based on macro-economic considerations taking into account the possibility of reduction in growth rates with time due to an enlarging base Peak loads were estimated after applying suitable annual load factors in the case of states and union territories and suitable annual diversity factors in case of regions The long-term forecasts are only indicative, and will therefore, have to be reviewed from time to time in light of perspective planning on a longer time horizon

**Table 4.9 Demand and supply forecasts for power in India (GW)**

| | 2001/02 | 2006/07 | 2011/12 |
|---|---|---|---|
| Peak load | 95 76 | 130.94 | 176 65 |
| Installed capacity | 126.04 | 181 1 | 242 |
| Peaking capability* | 88.92 | 129.82 | 146 67 |

*peaking capability has been calculated by multiplying the installed capacity by the peaking capability factor, which is taken as 72% for thermal, 75% for nuclear, 86.5% for hydro in the case of new capacity and 60 3% for thermal and nuclear and 91 55 for hydro in case of existing capacity

*Source* MoP, 1995, CEA,1998, Planning Commission, 1997c

The Sixteenth EPS, has scaled down the power requirements by 10% in view of the fact that the government does not expect economic recovery till the end of the Tenth Plan period According to the preliminary results available from the Sixteenth EPS, the peak demand at the end of the Ninth and Tenth Plan periods is 84500 MW and 118000 MW, respectively. The actual energy requirement is also projected to be lower at 535 GWh and 700 GWh compared to the earlier figures of 570 GWh and 782 GWh respectively.

**Table 4.10 Planned capacity addition in the Indian power generation sector (MW)**

| | 1997-2002 | 2002-07 | 2007-12 |
|---|---|---|---|
| Hydro | 9819.7 | 8550.7 | 27809 |
| Thermal (coal and gas) | 23545.5 | 46711 | 21074 |
| Thermal (liquid fuels) | 6000 | – | 5942 |
| Nuclear | 880 | 1706 | 4174 |
| Total | 40245.2 | 56987 | 58999 |

Source. CEA, 1998

The power supply position at the beginning of the Ninth Plan period was one of shortages. With a planned capacity addition of 40245 MW during the IXth Plan period (Table 4.10) and the demand as projected by the Fifteenth EPS, the reliability in terms of LOLP (Loss of Load Probability) is estimated to vary between 0.14% in the southern region and 19% in the northern and western regions which is much higher than the norm of 0.01%–0.001% in the developed countries.

According to the mid-term review of the Ninth Plan, it is estimated that only 70% of the targeted capacity addition or 28 115 MW will be achieved by the year 2001/02. While the central sector is expected to add 9760 MW as against the planned addition of 11 999 MW, the state sector is expected to add 9860 MW, which is close to the targeted addition of 10 748 MW. The private sector is expected to lag the targeted addition of 17 588 MW as it is expected to achieve only 8495 MW. The performance, however, is expected to be better than that during the Eighth Plan period (1992-97). Therefore, to keep the LOLP between two and five percent at the end of the Tenth Plan period, a much higher capacity addition will be required.

**Table 4.11 Fuel requirements for power generation in India**

| | Unit | 1997-2002 | 2002-07 | 2007-12 |
|---|---|---|---|---|
| Coal(indigenous) | mt | 276.5 | 418.8 | 487 |
| Coal(imported) | mt | 3.3 | 0 | 28.2 |
| Lignite | mt | 18.7 | 47.1 | 49.8 |
| Liquid fuels | mt | 7.7 | 0.6 | 4.2 |
| LNG | bcm | 2.9 | 0.4 | 1.2 |
| Natural gas | bcm | 10.7 | 12.2 | 12.2 |
| Nuclear fuel | Mkg | 0.4 | 0.6 | 1.2 |

*Source* CEA, 1998

The Plan-wise fuel requirements are provided in Table 4.11. Of the total requirement of 276.5 mt of indigenous coal, the power sector is expected to receive only 262 mt during the Ninth Plan period. This shortfall in coal supply may be attributed to constraints on production and transport infrastructure. The Ministry of Power has allocated 18.5 mt of naphtha and furnace oil for a capacity of 12 000 MW. The Ninth Plan envisages a total capacity addition of 6000 MW based on liquid fuels. The fuel requirements however, are expected to change with lower than targeted capacity additions by the end of the year 2001/02.

The planned capacity additions during the Tenth Plan period provided in Table 4.10 are based on the premise that there are no constraints on the availability of coal, transportation of fuel, and transmission of power. In this case, however, hydro power plants, which could yield benefits, are critically evaluated based upon their status and preparedness. The coal requirement estimated at 419 mt is higher in the period 2002-07 than that in the period 1997-2002 on account of capacity additions from mega power projects in the eastern region. The requirement for liquid fuels is much lower for the period 2002-2007 as the PLF (Plant Load Factor) of plants based on liquid fuels is expected to be much lower than that in the Ninth Plan period. Due to shortages for meeting the peak and energy demand, the liquid fuel-based plants are expected to operate at higher PLFs during the Ninth Plan, while liquid fuel based plants are expected to meet only the peak demand during the period 2002-2007.

When compared with the corresponding case for the period 2002-2007, the capacity addition during the period 2007-2012 period is estimated at 59 000 MW with a requirement of 565 mt of coal.

Some of the factors that are likely to impact the future capacity additions and fuel requirements for power generation are as follows

- Constraints on the availability of coal leading to the development of more liquid fuel- based plants.
- Limited availability of coal resulting in higher PLFs for liquid fuel-based power generation and hence greater requirement for liquid fuels.
- Development of LNG pipelines, thereby replacing the demand for liquid fuels by LNG
- Development of coastal shipping resulting in the replacement of imported coal by indigenous coal.
- Higher production levels for indigenous coal and better transportation infrastructure resulting in the replacement of imported coal and liquid fuels by indigenous coal
- Environmental constraints in setting up of hydro-electric projects will result in a shift towards thermal and nuclear projects
- Rationalization of fuel prices
- Development of power generation capacity based on non-conventional energy sources

# References

1 CEA 1998 *Fuel Map of India* New Delhi Central Electricity Authority (Planning Wing, IRP Division)

2 IEA 1998 *World Energy Outlook* International Energy Agency Paris

3 IEA 1999 *Coal* International Energy Agency Paris

4 MoP 1995 *Fifteenth Electric Power Survey of India* New Delhi Central Electricity Authority, Ministry of Power, Government of India

5 Planning Commission 1998 *Sectoral Energy Demand in the Ninth Plan and the Perspective up to 2011-12 A Technical Note* New Delhi Planning Commission (Perspective Planning Division) Government of India

# Chapter 5: Energy security concerns

## 5.1 Energy security concerns for South Asia

Uninterrupted energy supplies constitute the cornerstone of any industrializing regime. In fact, in light of the increasing oil demand-supply mismatch, which points to a growing dependence on imports, energy security concerns have assumed a greater significance in the South Asian region. Some options that need to be developed proactively to reduce the demand-supply gap have been discussed in this chapter However, it will be worthwhile to discuss some of the strategies that need to be developed and implemented in a coordinated manner so as to enable an effective response to an oil supply disruption

On account of lack of regional reserves, the countries in South Asia are likely to experience a higher reliance on the oil reserves in the Middle East and would therefore be faced with the uncertainties associated with oil exports from the region In this respect, some of the prime energy security concerns emerge from the fact that the Middle East accounts for 672 billion barrels or 63% of the world's proven oil reserves

However, it is feared that the low oil prices since the Gulf War in 1991 may lead to a decline in the economic growth in these countries with a consequent reduction in production levels unless private investments are stepped up Furthermore the US sanctions on Iran and Iraq may lead to locking–up of reserves in these countries, and in the context of imports from Central Asia, these sanctions assume greater significance since the world's access to these resources would have to be routed through Iran The other major concern for the security of supply stems from the politically unstable environment in the Middle East, which is largely a result of the power vacuum that was created as a consequence of the end of the Cold War between the US and Soviet Union. Security of oil in transit also remains a key issue involving a high degree of surveillance of the sea-lanes of communication and potential choke points and requires extensive cooperation amongst the navies of the region

From past experiences of oil supply disruptions it can be inferred that the initial structural conditions, including the share of the public and private sectors in the economic activity, and the degree to which the market and the central planning authority provide signals for economic decision making, determine the country's ability to adjust to the crisis In general, greater the role of the public sector, the more difficult is the adjustment process, and the more extensive the reliance on the centralized decision making process, the slower the pace of necessary reforms (Hamid and Zahid, 1994). Coordination of policies and the inter-linking of prices amongst the countries of the region is therefore particularly important to formulate an effective response strategy.

Therefore, in view of the oil security concerns outlined in the preceding paragraphs, it is necessary to evaluate the potential for oil supply disruptions, assess the major concerns for the oil supplying countries and develop an appropriate response strategy in a proactive manner through cooperation amongst the countries in South Asia.

## 5.2 The potential for oil supply disruptions

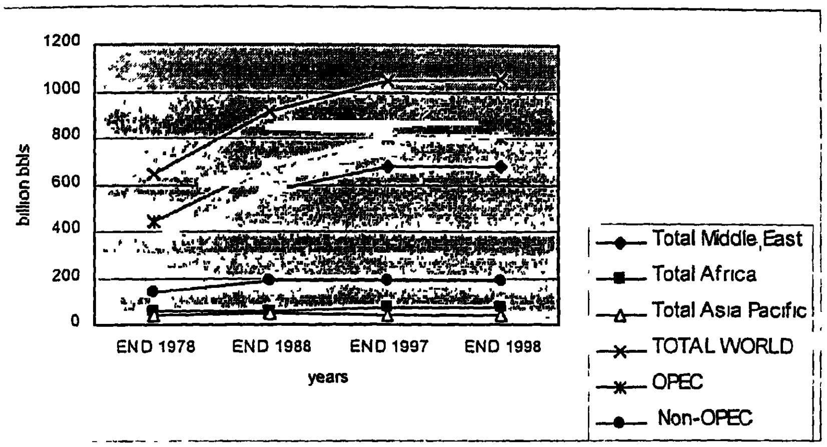
Some of the factors that determine the potential for oil supply disruptions include distribution of world oil resources, market shares of oil producing countries, and the strategic routes for oil supply These factors have been discussed in the following paragraphs

The British Petroleum Statistics estimates that the OPEC[1] countries contain about 800 billion bbls or 76% of the proven crude oil reserves in the world (Figure 5 1) The Middle East reserves are currently estimated to be as high as 672 billion barrels, constituting about 84% of the Oil Producing and exporting countries (OPEC) reserves and 63% of the total world reserves The share of the Former Soviet Union has been estimated at about 63 billion bbls or 6% of the total world reserves, however despite the close proximity of these reserves, they are not expected to play a dominant role due to infrastructural constraints The US Geological Survey has estimated the world's ultimate resources of oil at 1.6 trillion barrels of which the OPEC countries hold over 55% On the other hand the OPEC's own estimates put world discovered and undiscovered reserves at 1 5 trillion barrels of which they believe they hold 64% At present the OPEC countries are producing oil at the rate of 1 3% of their proven reserves, while the rest of the world is producing at the rate of 5 9% per year It is evident therefore, that the world is drawing down their resources at a much higher rate than the OPEC, thus pointing to an increasing share of the OPEC in the future world oil resources and production

---

[1] The OPEC comprises of Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, UAE, Venezuela

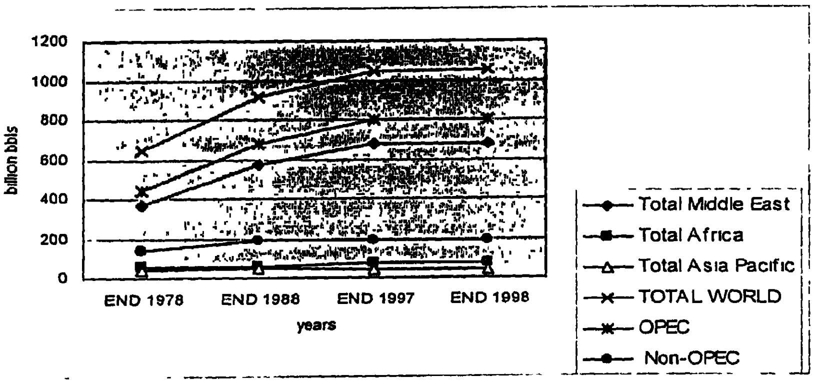
**Figure 5.1 World oil reserves**



*Source* BP Statistical 1998

Table 5 1 provides the world crude oil demand and supply projection for the year 2010/11. In South Asia the demand for crude oil is estimated to increase at a rate of 4 5% in the period 1995-2010 compared to the growth rate of 2% for the world Also the share of the Middle East OPEC in the total oil supply is estimated to increase from 35.5% in 1995/96 to as much as 89 5% in the year 2010/11 (Table 5 1)

**Table 5.1 World crude oil demand-supply balance (mb/day)**

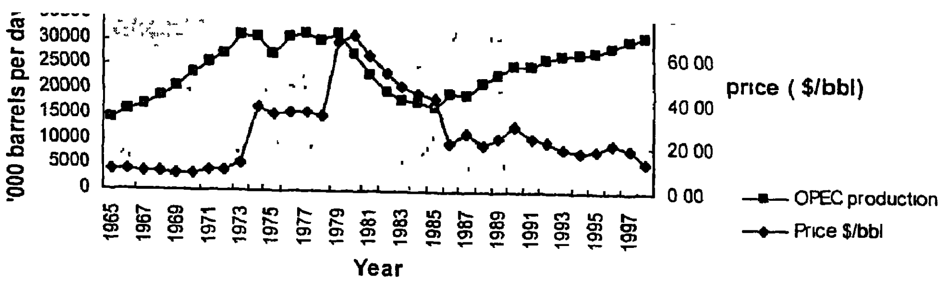


*Source* IEA, 1998

OPEC has been described as a cartel of the Stackelberg type, differing from a pure monopolist in that it holds a large enough market share to influence prices, but its monopoly influence is limited by the existence of competitive suppliers. In fact, OPEC has been described as the only structured group of sellers in world energy trade, that can make pricing and production decisions effecting the entire world energy market. Other energy sellers are scattered, or separate entities, with no common or coordinated policy action other than the objective of securing and maintaining a market share at a price high enough to allow them to continue investing in the industry.

The fact that the OPEC functions as a monopolist and not as a competitive cartel is also evident from the trend in production It has been argued that if the OPEC were a competitive cartel, it would not cut-back production when the oil prices increased in the period 1973-75 and then again in 1979-82 (Figure 5.2). The enormous difference between the market price and the cost of production of an additional barrel of oil would have induced them to increase their production That the OPEC has exercised and can exercise monopoly power in the world oil markets by cooperating to curtail production is a widely accepted view

**Figure 5.2 OPEC crude oil production and world oil prices**



*Source*. BP Statistical 1998

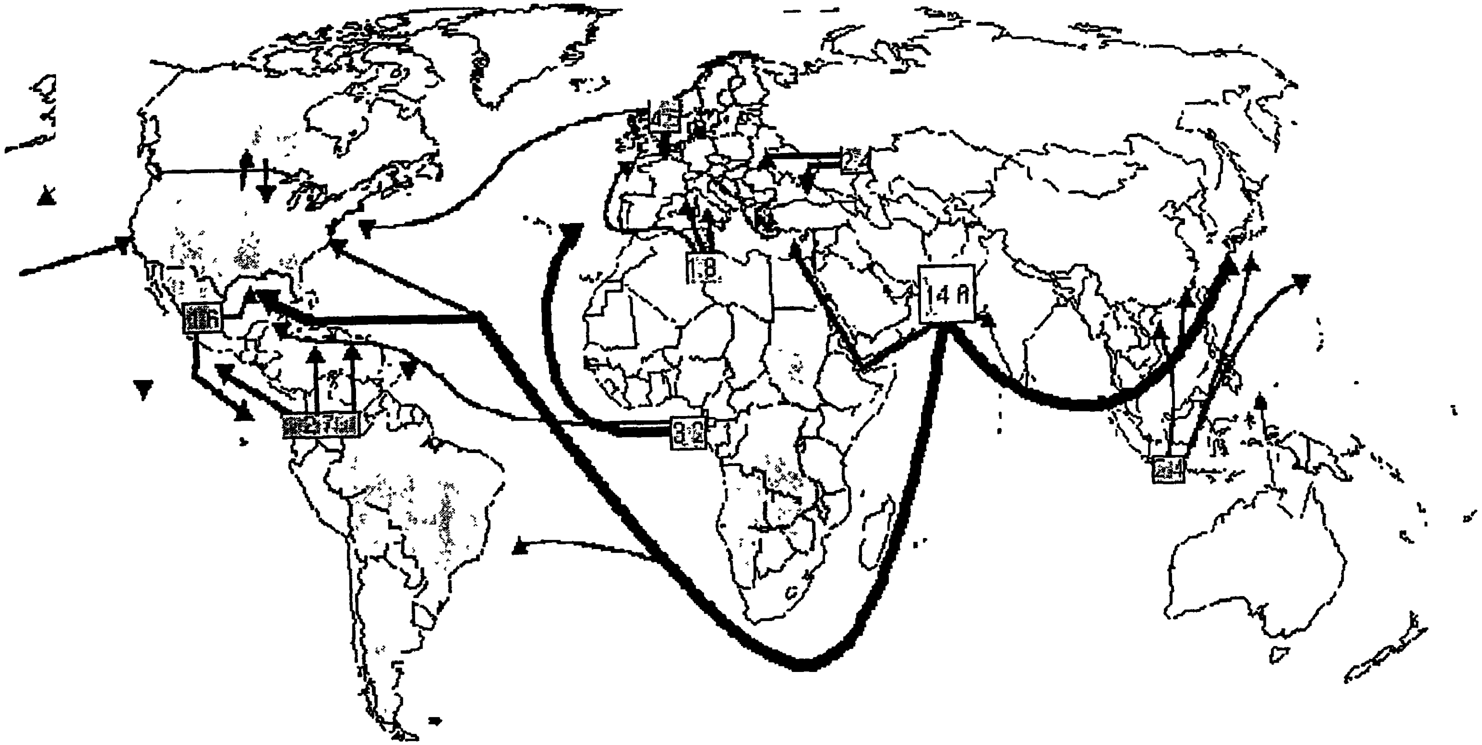
The total crude oil flows in the world are estimated at 34 8 mb/d. Of this 14 6 mb/d flows out of the Persian Gulf through the Strait of Hormuz to South and South-east Asia, Japan, the Mediterranean Basin, and the Gulf of Mexico India's total crude oil imports are 0 7 mb/d or 4 7% of the total exports from the Persian Gulf, assuming that bulk of the oil is imported from the Persian Gulf

In order to ensure security of supply it is necessary to identify the potential choke points in the sea-lanes of communication These routes are known as choke points due to their potential for closure Disruption of oil flows through any of these export routes as indicated in Figure 5 3 could have a significant impact on the world oil prices

Figure 5 3

## World Crude Oil Flows 1997

34.8 Million Barrels Per Day



Energy Information Administration

## 5.3 Major concerns for oil supplying countries

A brief analysis of the major concerns regarding the oil industry in some of the major oil supplying countries is provided below These countries are experiencing political, economic, and/or diplomatic uncertainty which could significantly affect their oil sector and lead to oil supply disruptions.

In 1991, the Gulf war diverted the attention of the policy makers, with disastrous effects on the economy of the region. The region is now only beginning to recover from adverse effects, fiscal and political The infrastructure needs in the Gulf have also increased in the last few years. Although certain countries have invested in infrastructure, meeting future requirements will be difficult unless private investment is brought in The case for privatization also rests on the relative efficiency of private enterprises compared to public ownership

### *5.3.1 Iran*

The Iran-Libya Sanctions Act (ILSA) was passed unanimously by the Congress and signed into law by President Clinton in August 1996 ILSA imposes mandatory and discretionary sanctions on non-U S companies which invest more than $ 20 million annually (lowered in August 1997 from $ 40 million) in the Iranian oil and gas sectors The passage of ILSA is not the first U.S sanction against Iran In early 1995, two Executive Orders were passed prohibiting U S companies and their foreign subsidiaries from conducting business with Iran The Orders also banned any "contract for the financing of the development of petroleum resources located in Iran " As a result, U.S -based Conoco was obligated to abrogate a $ 550-million contract to develop Iran's offshore Sirri A and E oil and gas fields

The threat of secondary U.S. sanctions has deterred some multinationals from investing in Iran In August 1996, Australia's BHP pulled out of a proposed $ 3-billion pipeline project to transport Iranian natural gas to Pakistan and India. Meanwhile, other firms have committed to sizeable oil and gas sector projects in Iran despite U S sanctions. In particular, Total of France and Petronas of Malaysia are proceeding with development of the Sirri A and E oil and gas fields, and a consortium led by Total is in the process of developing the South Pars gas field Total has escaped U S. sanctions for its Sirri deal because despite the large investment of $600 million, the deal was signed prior to the enactment of ILSA. Petronas, which acquired a 30% stake in the Sirri deal in 1996, stated in early March 1998 that it would not withdraw from the project despite U.S. objections. Following the passage of ILSA, Iran and Turkey have signed a 22-year gas supply deal estimated at $ 20 billion.

Despite U.S government opposition, Turkish officials stated in March 1997 that they were proceeding with the construction of the required infrastructure.

Attempts by the United States to implement ILSA has been opposed by a number of countries. The European Union, for instance, believes that ILSA is "unacceptable" and has barred European companies from complying with it. One possible loophole under ILSA is a provision which allows waiver of sanctions for countries that take "significant steps, including the imposition of economic sanctions" towards Iran. The EU argues that it has taken significant steps towards restricting Iran's access to weapons of mass destruction and has cautioned that the imposition of sanctions on Total could lead to a trade war with the United States

### 5.3.2 *Iraq*

Prior to the conflict in 1990, Iraq produced over 3 m b/d and exported 2 8 m b/d (1 6 m b/d via the Turkey pipeline, 800,000 b/d via the IPSA2 pipeline across Saudi Arabia, 300,000 b/d from Iraq's Mina al-Bakr export terminal, and somewhat less than 100,000 b/d by truck through Turkey) In 1990, Iraqi oil exports were forbidden by the U N Security Council Resolution, subsequently, in April 1995, the Security Council passed a resolution, allowing for limited exports of Iraqi oil for humanitarian and other purposes Iraq resumed oil exports exporting under this resolution in December 1996

The compliance with cease-fire terms is the main pre-condition for lifting of the UN sanctions In 1998, the U.N approved an increase in oil sales to $ 5 265 billion from $ 2 14 billion, over a 180-day period Iraq has claimed that it is able to export only about $ 4 billion worth of oil over a period of 6 months due to technical constraints, and would need additional infrastructure investments, that have been banned under the sanctions, to boost exports

In anticipation of the eventual lifting of sanctions, Iraq has signed oil and gas deals with companies from Russia, France, and China In March 1997, for instance, a consortium headed by Russia's Lukoil signed a 23-year, $ 3 8 billion oil production-sharing deal, for the development of the West Quma oilfield French oil companies, Total and Elf Aquitaine are also negotiating the production-sharing agreements for the Nahr Umar and Majnoon fields Iraq has also invited international partners to invest in natural gas projects worth $ 4.2 billion.

### 5.3.3 Libya

Libya is the target of both multilateral and unilateral sanctions because of its continued refusal to extradite the suspects in the 1988 bombing of the PanAm Flight. The United Nations first imposed sanctions in 1992 and later extended them to include, a freeze on Libyan funds overseas, a ban on the sale of oil equipment for oil and gas export terminals and refineries, and tougher restrictions on civil aviation and arms sales. In August 1996, the United States enacted the Iran and Libya Sanctions Act of 1996, which extended to cover foreign companies that make new investments of more than $ 40 million over a 12-month period, in the Libya's oil and gas sectors The sanctions have compelled Libya to adopt a conservative fiscal policy and the development of oil production capacity

### 5.3.4 Nigeria

The execution of minority rights activist Ken Saro-Wiwa in 1995, triggered a wave of international condemnation and sanctions against Nigeria In 1997, the Commonwealth voted to continue the suspension of Nigeria's membership and imposed an oil embargo, unless civilian rule was restored Although ethnic violence and sabotage have hindered oil production, notably in the Ogoni and Warri regions, Nigeria has maintained its crude oil production of 2 2 million bbls/d

### 5.3.5 Indonesia

A serious financial crisis affecting most of East Asia has exacerbated the underlying political and social tension in Indonesia In 1998, violence erupted throughout the country in response to higher prices of food and basic commodities and soaring unemployment Though the International Monetary Fund (IMF) put together a $ 43 billion rescue package, the assistance could be put at risk if the necessary economic reforms are not implemented

The impact of the crisis on the oil and gas sector, which has large foreign investments, could have widespread repercussions The country already plans to delay the construction of its first private sector refinery LNG exports have also declined as a result of the crisis and production may need to be cut-down, unless alternative export outlets are found. South Korea canceled the purchase of 15 cargoes in 1998, and Thailand has also delayed the purchase of gas from the Natuna field

Similarly other countries in East Asia, notably South Korea, Thailand, and Malaysia are experiencing a contraction in their economy and are struggling to regain value for their depreciated currencies and maintain investor confidence. The crisis has also resulted in the cancellation or delay in energy projects thereby hampering the economic development of the region

## 5.4 Oil supply disruptions: lessons from the past

A number of externally generated oil shocks during the last two decades have adversely affected the developing economies in Asia The shocks have resulted in severe current account deficits, increased prices and sharply reduced incomes with consequent impacts on immediate stability and long-term economic growth Notable amongst the oil shocks during the last twenty years were the oil price increase in 1973 and 1979 and the oil supply disruption during the Gulf war in 1990

Virtually all the spare oil production capacity was in the Middle East when the Arab Oil Embargo began in October 1973 Supply disruptions increased in severity as world oil demand increased and production shifted to less secure areas of the Middle East The 1973 the Arab Oil Embargo was the first oil supply disruption to cause major price (oil price as much as quadrupled) increases and a worldwide energy crisis. The two major impacts of the crisis were a drop in export prices and an increase in import prices, thus leading to a recession in net export demand

In 1979 the oil price increased by two and a half times The adverse impact ranged from 1% of GNP in Bangladesh to as much as 25% for Sri Lanka, while in India the impact was mainly on trade volumes In order to mitigate the impact on the balance of payments, policies with respect to export promotion, import substitution, and privatization were adopted

The main adverse consequences of the Gulf crisis on developing Asian countries were balance of payments pressures, widening budget deficits, and increasing inflationary pressures The increase in oil prices by about $ 6, directly affected the balance of payments for oil importing countries and inflation rose from 11 5% to 21 5% in Sri Lanka, 6.2% to 9 0% in India, and 7 9% to 9 0% in Pakistan (Table 5 2) This could also be attributed to an increase in import volume as a result of panic-buying

In most countries the budget was adversely affected since most governments had additional expenses due to repatriation, and this was especially high in the case of India Higher energy costs and loss in revenues from reduced non-oil exports also impinged upon the budget In the case of countries that did not pass on the price increase in oil-related products to the consumers, budgetary losses were higher

**Table 5.2 Select indicators of the impact of the Gulf crisis on some Asian countries (August 1990-February 1991) ($ million)**

| Indicator | Bangladesh | India | Pakistan | Sri Lanka |
|---|---|---|---|---|
| Increase in oil import bill | 170 | 1750 | 580 | 153 |
| Lost remittances | 115 | 200 | 144 | 70 |
| Repatriation outlays | 16 | 200 | 33 | 45 |
| Total losses | 342 | 2544 | 764 | 324 |
| Total losses as % of GDP | 1.6 | 1.2 | 1.9 | 4.5 |
| Total losses as % of current account deficit | 27.4 | 39.5 | 41.2 | 40.9 |

*Source* Hamid and Zahid, 1994

The Indian economy, like the other economies of the region took long to adjust to the shock because of the poor macro-economic conditions at that time. In general, it can be said that factors such as the extent of deregulation and volume of imports determine the vulnerability of a country to the crisis and its ability to adjust quickly. India's adjustment policy relied heavily on reducing import dependency, with a modest, and a rather ineffective fiscal and monetary policy.

The impact of the shock largely depended upon the (1) extent to which the economy was regulated and controlled by the government (2) open-ness of the economy (3) dependence on imported oil. Analysis of experience with external shocks has demonstrated that those Asian countries with a more open and less regulated economy were able to cope with the shocks better. In general some of the observations and conclusions that can be derived from the past experiences are

- The country's ability to carry out the necessary adjustment policy is determined by the role of the public and private sectors in the economic activity and the degree to which the market activity and the central planning authority provides signals for economic decisions. In general, greater the role of the public sector, the more painful is the adjustment policy and the more extensive the reliance on the centralised decision-making process the slower the pace of reforms.
- The initial macro-economic conditions are critical to a country's success in adjusting to external shocks. These include the size of current account deficit, the state of the budget, the level of internal reserves and the level of external debt. In this respect the successful adjustment policy in Korea, despite its high import dependence, needs to be highlighted.
- Co-ordination policies are also important. This is most evident in the interlinking of price alignment, fiscal policy and devaluation. When the domestic price of an imported input whose foreign price has increased is allowed to rise in order to reduce demand and thus lessen the

impact on the current account, inflation may be precipitated. Policy measures must therefore include the prevention and control of inflation. Devaluation must also be considered to reverse the deterioration of the current account, even though it would precipitate inflation However inflation cannot be controlled if the government is subsidising consumers and financing loss-making enterprises The abolition of subsidies achieved through fiscal restraining is therefore vital to the success of the adjustment policy.

The adjustment policies for the countries in South Asia, included, exchange rate devaluation, export promotion, import substitution, tax intensification, price increases and demand restraint through administrative measures and restrictions. It is difficult to ascertain what constitutes an effective adjustment policy, however, what needs to be emphasised is that the timing and coordination of policies, rather than the comprehensiveness of the policy is critical to successful adjustment

Pricing policy is critical in managing demand. After the Gulf crisis, most Asian countries had adjusted domestic prices of petroleum and petroleum products so that they reflect international oil prices In most countries in the region oil pricing is still regulated by the government, and therefore the policy is normally designed to cushion the domestic consumers from the full impact of increase in international oil prices. In some countries an oil stabilization fund is maintained, which is used for stabilizing large price swings by cushioning the consumers when the prices are high, and even when the international prices fall, the domestic prices are kept high so as to generate revenue for the future operations of the stabilization fund.

It is interesting to note that most countries following the administered pricing mechanism were unable to readjust the price downwards when international prices returned to normal levels This can be attributed mainly to the system of subsidies which necessitated an upward adjustment higher than if there were no subsidies

Therefore it can be said that oil shocks pose difficult problems for oil importing countries In the short run oil demand is price inelastic and reducing oil consumption through administrative or restrictive measures may lead to a decline in economic output

## 5.5 Response strategies

In designing a response mechanism for South Asia, one does not have to start from scratch The International Emergency Program of the OECD countries provides a framework, which can be used with the necessary changes. As a response to the oil crisis of 1973, the OECD countries formed the IEA to implement the International Emergency Program (IEP). Emergency response is the main element of the IEP and it includes the important commitment of the member nations to hold oil stocks equivalent to 90 days of net oil imports in the preceding year The IEP has defined an integrated set of emergency response measures, comprising of stockdraw, demand restraint, fuel switching, enhanced oil production and sharing of available supplies at the time of a disruption involving a loss of 7% or more of oil supply to the IEA member countries as a whole or any individual member. For oil disruptions that do not reach the 7% threshold, a complementary set of measures known as Co-ordinated Emergency Response Measures (CERM) have been constituted (IEA, 1995). These provide a rapid and flexible system of response to actual or imminent oil supply disruptions. Annual exercises are undertaken for testing and improving the procedures for stockdraw and emergency oil sharing between member countries During the Gulf crisis in 1990, the contingency plan to make available 2 5 million bbl/d of oil, consisted mainly of stockdraw However stockdraw may not be sufficient to calm the market, as there may be panic buying thus increasing the demand and price. In order to optimise the impact of stockdraw on the market, a certain amount of demand restraint may need to be exercised synchronously

In recommending a strategy for South Asia, it is necessary to develop a sophisticated information system and energy database for public use This system needs to become the primary information base for energy forecasting since quality information and market transparency are the key to energy supply management both at normal times and during emergencies.

### *5.5.1 Strategic stockpiles*

Strategic stockdraw is regarded as a vital element in the emergency preparedness of the IEA countries According to the IEP norms, net oil importers have a stock-holding obligation equivalent to 90 days' of net oil imports in the preceding year

The factors that are crucial to the success of a strategic stockdraw are (IEA, 1994):

- The timing and information about release is crucial in mitigating the impact of a crisis on the price Over the past decade there has been a growing appreciation of the critical role played by oil supply information in influencing market behaviour.

- A key factor characterising supply disruptions is that their extent and duration are unknown. This makes it difficult for any government to decide the timing and the level of drawdown of the emergency stock.
- A market determined competitive selling price of the stock provides the government with the clearest information on industry feedstock requirements, permitting an effective response to emergency conditions. In addition, using a market determined stockpile distribution mechanism provides a means through which supply problems can be mitigated without further disruption
- National legislation or government regulations to ensure compliance to the stipulated emergency reserves to be held by the government, oil companies or stock-holding agencies need to be established

In India the oil industry maintains an operational inventory of crude oil and petroleum products The Oil Co-ordination Committee (OCC) monitors the inventory levels on a monthly basis and the cost of maintaining the inventory is covered under the administered pricing mechanism So far a greater reliance has been placed on the purchase of crude oil on long term contracts rather than on building up a strategic reserve In view of the expected increase in product demand to 113 million tonnes and rise in import dependency to 74% by the year 2002, the government has initiated an action plan to enhance the operational stockholding requirement of companies to 21 days and to provide a 45 days strategic cover for imported crude oil and a 30 days cover for petroleum products (TERI, 1998)

Efforts are also underway to augment the tankage facility by allowing private and foreign investors in infrastructure development on a build and transfer basis The location of the strategic storage sites will be determined on the basis of the demand centres and will be spread across the country However, the operation and management of the storage facilities will be undertaken by the government either through state-run companies or a separate body This is due to the belief that left to itself, the oil industry would hold a sub-optimal level of stocks

It should be noted however, that although stocks may be held by the government or a government appointed agency, the full co-operation of the industry is in any case essential if the stock has to reach the consumer in the crisis period In India, the government owns a sizeable part of the oil industry and is capable of effecting supplies directly However, the situation is changing with increasing divestment of public undertakings and the government will have to arm itself with the necessary powers to secure compliance by the industry

In designing the emergency reserve program, several governments have opted for storage of crude oil as well as petroleum products While under certain circumstances this may prove judicious, the following reasons support the choice of crude oil for emergency stocks:

- Crude oil is the easiest and least expensive to store,
- Crude oil does not present the problems of deterioration and recycling of inventory that storage of most products entail,
- Crude oil is convertible to all other products In most conceivable supply crises the refining sector is likely to have some spare capacity and therefore there is a flexibility to meet the desired product mix, under seasonal quality adjustments and changes in demand pattern due to demand restraint During the Gulf war in 1991, even though two major refineries were destroyed, worldwide refining capacity was sufficient to meet the demand,
- Petroleum product stocks may not be used or may be of the wrong quality As an example, stockpile of heavy fuel oil is of no use in a situation where the refining system is running heavier crude oil than usual and is producing excessive fuel oil In other cases stocks of leaded gasoline have been proven obsolete and need to be replaced at a large cost
- Most oil products are susceptible to deterioration due to the presence of compounds of sulphur, organic acid and oxygen if kept in storage for a long time. In some cases the deterioration is biological due to the development of micro-organisms in the liquid, in other cases problems arise due to volatility or from changes in market specifications because of which a stored product could become obsolete Preventive measures like treatment of products before storage are beneficial however they add to the final cost of the product

In recommending a stock structure for South Asia, no generic structure can be proposed however the recommendations are.

- Parameters such as storage costs, refining capacity, market structure and infrastructure need to be considered;
- A part of the SPR should be carried in the form of products since the refining capacity of 170.45 mt for the year 2010 in the case of India for instance, is less than the estimated demand of 197 21 mt The other advantages of holding product stocks include, an immediate impact on the

consumer markets and final consumer prices and a shorter lead-time for their marketing However, these advantages need to be qualified, since a decision to draw crude oil stocks has an immediate calming effect on prices and therefore the lead-time until it reaches the consumer is less important.

While storing products, the choice of products needs to be decided judiciously and products with a limited demand restraint potential; such as MS, SKO, HSD, LPG may be included.

- Economic factors should be considered so that, products which are expensive to stock should be included sparsely or not at all.

One of the most serious obstacles to a government stocking system is the financial obligation to maintain these stocks. Even though several governments in the world continue to opt for special oil levies, the most straightforward approach suggested by experts for financing emergency stocks is to pay for stocks from the general tax revenues. In case of special levies care needs to be taken to ensure that they do not introduce any competitive distortions, are uniform in rate among all categories of purchasers and apply to imported products and refinery feedstock

An approximate cost for maintaining strategic stocks of crude oil equivalent to 45 days of net imports in the preceding year in the case of India, has been provided in Table 5 3

The following assumptions have been used in the calculation

- 100% of the storage is in onland tanks
- Cost of storage in onland tanks is $ 10/bbl
- Import price for crude oil is $ 15/bbl (assuming that the stockpiles are created when the oil prices are low)
- Inventory carrying cost is calculated at the rate of 12% per annum

**Table 5.3 Cost of crude oil strategic stocks for India**

| Year | Days cover | Tankage required (million bbls) | Total capital costs (billion US $) | Average annual costs (billion US$) |
|---|---|---|---|---|
| 2005/06 | 45 | 95.47 | 2 38 | 0 17 |
| 2010/11 | 45 | 147 75 | 3 69 | 0 34 |

*Source*. TERI

The strategic storage costs for MS, HSD, SKO and LPG are provided in Table 5 4 and have been estimated based on the following assumptions:

- 100% of storage is in onland tanks
- Strategic tankage is calculated on the basis of demand in the previous year
- Average product cost is assumed to be 17 $/bbl and 18 $/bbl for the years 2006/07 and 2010/11 respectively
- Inventory carrying cost is calculated at the rate of 12% per annum.

**Table 5.4 Cost of MS, HSD, SKO and LPG strategic stocks for India**

| Year | Tankage required (million bbls) | Total capital costs (billion US $) | Annual costs |
|---|---|---|---|
| (billion US $) | | | |
| 2006/07 | 85.83 | 2.31 | 0.17 |
| 20010/11 | 120 69 | 3 37 | 0.26 |

*Source* TERI

The recommended financing options for developing strategic stockpiles are.

- Pay for stocks from general tax revenues rather than through a hidden cost in oil prices This is a viable financing option since the citizens benefit from the strategic stocks and therefore they should pay for them, and secondly, the impact of specific taxes may fall unevenly on some groups and may increase the incentive to avoid taxes In addition, auditing of special stock taxes could prove to be burdensome Hence, the taxes should be uniform in rate amongst all categories of purchasers and should apply to imported products as well as refinery feedstocks

  Taxes can also be used as analogous to an insurance policy that can be levied under normal times and taken off at the time of a crisis.
- The cost of storage can also be recovered if the stockpiles are created or enlarged when the prices are low and released when the market prices are high.
- In case of special levies care needs to be taken to avoid competitive distortions
- The options of a soft loan from multilateral organizations, may be explored

In the South Asian context it has been proposed that the cost for construction of tankages as well as the cost of carrying inventory should be borne by the government. Various options including the long-term leasing of the required tankage can be considered to minimise the financial impact of strategic reserves In India for instance, the expenses for maintaining strategic reserves may be met by the funds of the Oil Industry Development Board (OIDB).

The Indian government however has recently embarked upon an exercise to chalk out plans for the setting up of strategic storage capacity for oil. It has been proposed that initially 45 days inventory of imported crude (at a cost of Rs 12500 crores at 1995/96 prices or about 2.7 billion $) and 30 days inventory of finished products may be held as strategic stockpiles. Inventories covering MSL/GMR as required by the defence authorities as well as operational requirements of the oil companies will be additional to the aforesaid stock levels The location of the crude inventories could be in proximity to the refineries and the products could be located at strategically to ensure easy access to the targeted markets The costs of holding and managing the strategic storage may be recovered from the government as a cess the impact of which may be passed on to the oil companies The strategic reserves will be drawn only at the time of war, emergencies or an equivalent international/national disturbance The implementation of this programme is expected to secure the nation against volatility in the international oil market.

## 5.5.2 Demand restraint

The IEA has identified the strategic demand restraint policy objectives, which need to be achieved through international collaboration for long-term energy security and global linkages These objectives are applicable in the South Asian context as well The following is an abstract of the Shared Goals adopted by the IEA in 1993 (IEA, 1997)

- Global energy markets are less regulated than they were some years ago and governments across the globe are continuing to reform their role The precise effect of a particular market liberalisation measure on energy efficiency strategies will be highly dependent on the nature of measure introduced, the organisation of the market subject to reform and the prevailing economic conditions A competitive climate expands opportunities to find innovative technology solutions, diffuse them more rapidly and encourage diverse and flexible responses. Undistorted prices enable the market to function more efficiently Therefore energy prices should not be priced low so as to protect social or industrial interests. Free and open trade and a secure framework for investment contribute to efficient markets and energy security

- Technological advancements must be sought that increase the service quality and benefit per unit of energy employed There exist significant opportunities for energy efficiency in the entire fuel cycle from the point of production to consumption. Strong efforts are required by governments to recognise these opportunities. Cost-benefit criteria may be used to determine opportunities for trade-off among competing energy technology options Continued research and development and international co-operation in the development and dissemination of technologies make a critical contribution towards achieving this objective. Furthermore with declining budgetary support in developing infrastructure for new technologies, significant resource investments are necessary from the private sector through innovative financing schemes.
- Fuel diversification is necessary to increase the flexibility of the overall energy system from energy sources to end-use devices Diversity, efficiency and flexibility within the energy sector are basic conditions for longer-term energy security, the fuels used within and across the sectors and the sources of those fuels should be as diverse as possible Increased use of renewables can play an important role in this respect, however the major impediment is the lack of access to technology at competitive prices Similar capital and infrastructure constraints apply to the use of clean coal and natural gas based technologies

### 5.5.3 Technological interventions

Decisions to invest in energy-efficient technologies require clear and accurate information on energy prices, investment requirements, product performance and potential savings Some of the principal barriers that restrict transfer, adoption and development of technology in countries in South Asia are

*Price of energy* The price of energy is a fundamental determinant of whether energy saving measures are considered worthwhile, since energy efficient end-use technologies require major capital investments which are higher than for the technology they replace Consumers would compare the cost of energy savings when buying an appliance or equipment to the higher purchase price of the equipment Obviously, higher the price of energy the more attractive is the investment in the more efficient model

*Labels and standards:* A prerequisite for information on equipment performance is data based on energy audits and testing of equipment. Labels provide purchasers, information about equipment performance and energy consumption and are important in determining the life-cycle cost of appliances Energy labels also motivate the manufacturers to produce more efficient products. Standards and regulations related to energy efficiency are effective in establishing a minimum efficiency value and ban products that do not meet the stipulations They also enable the consumer to distinguish between the energy consumption values of different models and hence make their choice judiciously Additionally, the advantage of national standards extends across countries to which these products are exported

*Independent energy-efficiency institutes*: Experience in countries such as Japan and Korea has shown that an effective way to address some of the information intermediation barriers and policy barriers to efficiency is to set-up a high level, independent efficiency institute This is particularly important in the context of developing countries where most supply enterprises resist taking up the responsibility of energy efficiency, as it is conflicting with their objective of maximising sales The Korea Energy Management Corporation (KEMCO) for instance was established in 1980 to encourage energy efficiency. The corporation is entirely government owned but receives only 30% of its budget from the government while the rest is provided by revenues from its services to the residential, commercial and industrial consumers. KEMCOs current portfolio includes energy audits, financial assistance, promotion of cogeneration, support of R&D, general education and training and promotion of renewable energy technologies (World Bank Policy paper, 1993) Similarly in Japan the Energy Efficiency Centre (EEC), a public organisation works closely with the MITI for promoting efficient energy use The EEC and KEMCO offer a valuable model to the newly industrialising economies of the region

*Research and development* Research and development is vital to ensure long-term access to more energy efficient technology In this context, it is important to recognise the fact that energy technology has become increasingly global both in R&D and in application. The competitiveness of large firms will be dependent on their ability to draw on expertise and human resources from more than one country The main driving force that is leading to globalisation of energy technologies is the deregulation of markets and free trade. Unfortunately, investments to improve energy use technologies are assigned low priority in most countries In addition to government sponsored research and development, tax incentives can be provided to encourage the development of energy efficient technologies in the private sector Sometimes information on new technology may not be sufficient to promote technology adoption Hurdles including the lack of expertise of the purchaser, risk associated with the new technology, cost and availability may further retard the diffusion of energy efficient technology

*Financing options* Low energy prices and non-payment of delivered energy greatly impedes the financing of projects Mobilisation of private capital for energy efficiency investment requires that the investors have a minimum level of confidence and protection In this respect it is important for the domestic banking sector to provide access to long-term financing for energy efficiency measures which are often less lucrative than supply side projects as they may be smaller and may have longer pay back periods than other projects that compete for capital (e g telecommunications industry). To overcome the problems of the local banking sector Industrial Financial Institutions (IFI) can be instituted for providing local intermediary banks credit lines for energy efficiency investment. The lack of capital can be overcome partly, through innovative methods of financing such as leasing contracts, shared savings or third party financing

*Legal framework* Furthermore, the legal framework for enforcement of energy efficiency measures still remains weak. This increases the risk for investors and discourages long-term investments. Foreign investors also require safeguards to ensure that laws and regulations remain stable and predictable In addition, the system of patents and intellectual property rights needs to be made more efficient to facilitate the transfer of energy technologies from industrialised countries, which would seek the protection of such a system

*Role of stakeholders*· The use of energy is also influenced by the several stakeholders Therefore, success in energy efficiency programs depends upon their initiatives and the extent of integration in action. Some of the roles and functions of the stakeholders has been outlined below:

A successful energy efficiency strategy requires that the policy priorities outlined in the preceding paragraphs are clearly defined, that appropriate instruments are used in an integrated manner and that sufficient resources are deployed

## References

1. BP Statistics. 1998. *Statistical Review of World Energy 1998* England: The British Petroleum Company.
2. Hamid N, and Zahid S N. *Asian Development Bank* External Shocks and Policy Adjustments, Manila, 1994.
3. IEA. 1994 *Stockdraw and Emergency Response Policies and Management* Japan Japan National Corporation, International Energy Agency.
4. IEA 1995 *Oil Supply Security· The Emergency Response Potential of IEA Countries* Paris International Energy Agency
5. IEA 1997 *Energy Efficiency Initiative.* Paris International Energy Agency
6. World Bank 1993. *Energy Efficiency and Conservation in a Developing World* Washington DC The World Bank.

# Chapter 6: Prospects for investments in the energy sector

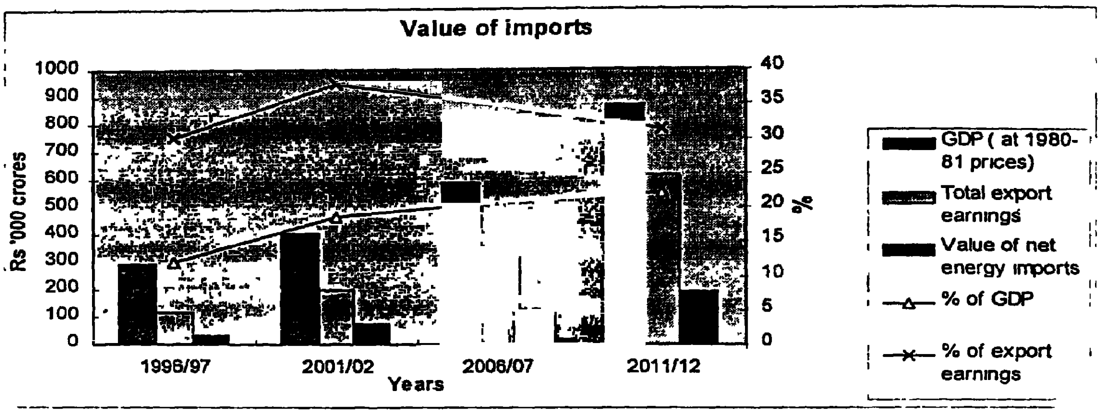
## 6.1 Imperatives for resource mobilization

In most countries of the region, the many demands placed on the state to meet a widening range of social and economic needs has strained the capacity of the state to continue financing energy enterprises In addition, financial constraints on account of the fiscal deficit and balance of payments situation has made an adverse impact on investments in the energy sector

Given the growing trend towards financial integration, developing countries need to pursue policies that will benefit from global capital flows In this respect the most important pre-requisite for successful financial integration is a sound macroeconomic policy framework that includes, a strong fiscal position, the absence of price distortions, a sound domestic banking system, and adequate legal and regulatory framework These preconditions improve the creditworthiness of the country, and encourage capital flows in the longer term (World Bank, 1997)

Free and open trade and a secure framework for investments are important pre-requisites for the development of efficient markets for assuring uninterrupted energy supplies that constitute the cornerstone of any industrializing regime In fact, in light of the increasing oil demand-supply mismatch, which points to a growing dependence on imports, energy security assumes a great significance in the South Asian context. Energy infrastructure projects ranging from developing the primary fuel source, its transportation and conversion to useful energy services, are usually complex in their investment requirements The development of energy infrastructure has so far been primarily in the public domain, however, in light of the growing gap between energy demand and supply it has become necessary to increase the role of domestic capital markets and international development finance. Figure 6 1 illustrates the growth in energy imports as a percentage of the GDP and export earnings for India

**Figure 6.1 Value of imports**

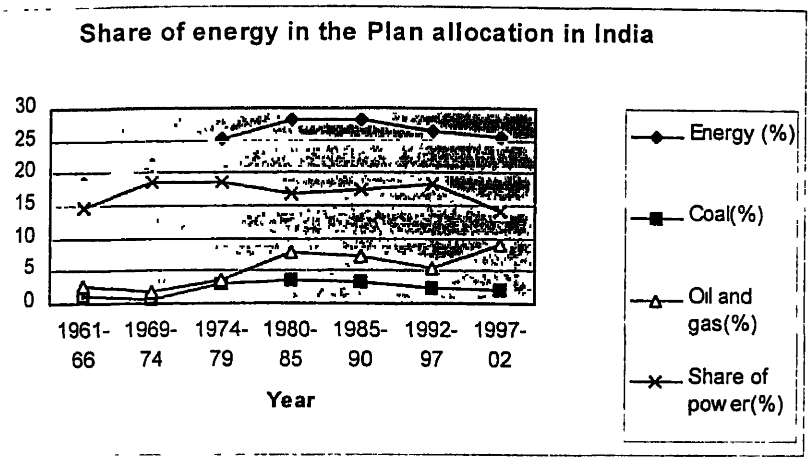


Source. TERI

Fuel diversification is necessary to increase the flexibility of the overall energy system from energy sources to end-use devices. Diversity, efficiency and flexibility within the energy sector are basic conditions for longer-term energy security, the fuels used within and across the sectors and the sources of those fuels should be as diverse as possible Increased use of renewables can play an important role in this respect, however the major impediment is the lack of access to technology at competitive prices Similar capital and infrastructure constraints apply to the use of clean coal and natural gas based technologies

Technological advancements must be sought to increase the service quality and benefit per unit of energy employed There exist significant opportunities for energy efficiency in the entire fuel cycle from the point of production to consumption Strong efforts are required by governments to recognise these opportunities and continue research and development through international co-operation in the development and dissemination of technologies. Furthermore with a decline in the budgetary support in developing infrastructure for new technologies, significant investments are necessary from the private sector through innovative financing schemes Given the enormous resource requirement in developing the energy infrastructure sector, and the decline in the budgetary support as illustrated in the case of India (Figure 6 2), the government needs to evolve a policy towards encouraging investments form both the public and private sectors

Figure 6.2 Share of energy in the plan allocation in India



*Source* TERI

Even though, sufficient finance is available for the global energy sector requirements, there exists a problem in mobilizing finances for energy investments in developing countries, where 90% of the future energy demand is expected to occur Capital markets have reportedly grown faster than the GDP in most countries in South Asia, as in other parts of the world, and this trend is expected to continue in the future It is therefore not the size of the capital market but the high investment risk and the low rate of return in energy sector projects that has limited energy sector finance It is, however, important to note that all projects in developing countries may not offer a high rate of return due to social and economic inequity, and it is for this reason that the role of international development finance needs to be emphasized through concessional and priority lending

Attracting finances both in the form of domestic and external investment requires that governments adopt appropriate policies with respect to pricing and regulation, so as to create an enabling business environment that allows both public and private sector industries to function as commercial enterprises Recent studies by the World Energy Council indicate that the cumulative capital requirement for the energy sector in the period 1998-2020 ranges from $13 trillion to $ 20 trillion Developing countries alone would be required to invest about $ 2 trillion per year or 3%-4% of the GDP in developing energy infrastructure (WEC,1999).

## 6.2 Investment requirements

### *6.2.1 India*

The investment requirements for India are calculated based on the energy demand and supply projections provided by the Planning Commission, Government of India. The total investment requirements for setting up of new coal mines to meet the projected demand for coal primarily in the power generation sector has been estimated at $3.5 billion and $4 4 billion for the Xth and XIth Plan periods, respectively The investment requirements have been estimated using a norm of $22 million/mt of coal capacity, and do not include the costs for operating the existing mines In view of the decline in the plan allocation for the coal sector these investment requirements would require increased public and private sector participation in the development of new mines

In the oil and gas sectors in India, the total investments including investments for enhancing crude production, setting up of new refining capacity and LNG terminals is estimated at $10 billion and $14 billion in the periods 2002-2007 and 2007-2011, respectively The investment requirements are higher during the XIth Plan period as compared to the Xth Plan period mainly due to the large refining capacity addition of 50 mt that is expected in the XIth Plan period The investment requirements have been calculated using norms of $ 222 million/mt for refining capacity addition, Rs 45 billion/3mt for crude production and $ 450 million/3mt of LNG terminal In addition, it is estimated that the cost of technological upgradation for the production environment-friendly fuels in compliance with the emission norms for the transport sector is estimated at $ 3 billion Also the expenditure that would be incurred by the oil industry for port development is estimated at $ 133 million

In the Indian power sector the investment requirement including generation capacity addition and development of transmission and distribution infrastructure is estimated at $98 billion and $111 billion for the periods 2002-2007 and 2007-2011, respectively These figures have been calculated using a norm of $1.7 million/MW of installed capacity The total investment requirements for the period 2000-2010 is estimated at $245 billion, which would include investment requirements for restructuring the SEBs, operation and renovation and modernization of existing plants It is estimated that a delay in the implementation of the reform process would increase the investment requirements by $33 billion NTPC is planning a mix of ECB and domestic borrowings for financing its power projects However, according to the new ECB announced by the government, the public sector undertakings would be required to raise funds from the international market on the strength of their balance sheets without the provision of any sovereign cushion The corporation has also sought tax benefits available to projects executed through multilateral funding to all projects implemented through the international competitive bidding route.

In Bangladesh, the Power System Master Plan has projected a power demand of 16500 GWh by the year 2000 and 24160 GWh by the year 2005, thereby necessitating a capacity addition of about 3.1 GW by the year 2000 and 3 3 GW by the year 2005, at an estimated cost of $ 4 4 billion. The investment required for the corresponding expansion of the transmission and distribution system is estimated at $ 2.2 billion

A total investment of $ 4 billion has been committed by the government and the private sector for the development of the refining capacity and infrastructure for transportation of petroleum products in Pakistan Pakistan State Oil which has committed a total investment of $ 407 million has a major share in these investments With the expected increase in oil imports efforts are being made attract private investment of about $ 1 5 billion for the construction of pipelines, expansion storage facilities, and augmentation of the rail and port infrastructure The estimated cost for the augmentation of gas infrastructure is estimated at $ 1 billion

In the power sector, a total investment of 3 5$ billion is estimated for generation capacity addition in the period 2000-2005. The WAPDA has estimated a total investment requirement of $ 8 billion in the period 2000-2010 for the development of the transmission and distribution network alone. Therefore, in view of the key role played by electric power in the economic growth and development, restructuring and privatization of the power sector has been high on the government's agenda

## 6.3 Reform indicators

A World Bank survey of 115 developing countries shows that on an average only 39% of energy sector reform, defined as the process facilitating private ownership and competition, were achieved by mid-1998 (Table 6 1) While this section evaluates the reform process in South Asia in quantitative terms, the subsequent chapters outline the energy policy in the countries of the region.

The factors that have been addressed to evaluate the reform indicators include (i) steps for allowing private sector investment, and (ii) extent of privatization.

According to the World Bank, the most logical sequence of reform towards private sector participation and competition is as outlined below:

- Corporatization and commercialization of the state owned enterprises
- Legislative amendments allowing private sector participation
- Regulation to implement the government policy and ensure protection of interests of the consumers and producers
- Privatization or disinvestment of existing assets

The survey results have demonstrated that formal regulation or restructuring of the power and upstream oil and gas sectors has been much less than private investment itself This is because most countries are in the process of augmenting investments by allowing private investments for new sites with a contract for sale to the state-owned utility, rather than preparing for privatization and the creation of competitive markets It should be noted however, that privatization does not necessarily imply that the government should relinquish its authority to regulate This aspect assumes significance, in light of politically sensitive issues such as the extent of freedom to the electric utilities being privatized, in adjusting the tariffs in the domestic and agriculture sectors However, it needs to be emphasized that if private capital is to provide the basis for funding, the issue of ownership will need to be addressed, with the role of the state transforming from that of ownership to providing a regulatory role as a guardian of public interest

**Table 6.1 Energy reform indicators (as % of maximum)**

| Region | Power | Upstream oil and gas | Downstream gas | Downstream oil (refining) | Downstream oil (wholesale and retail) | Average |
|---|---|---|---|---|---|---|
| World average | 50 | 50 | 50 | 44 | 27 | 46 |
| South Asia | 34 | 49 | 38 | 35 | 32 | 39 |

*Source* World Bank, 1999

The upstream oil and gas sector in South Asia has shown a substantial degree of reform (49%), largely because of the high costs and risks involved in exploration and production (Table 6.1) In countries where the state cannot meet the financing requirements, private finance is encouraged through concessions (Table 6 2) Such concessions may require laws to be amended and restructuring of enterprises In some cases the government has been willing to privatize existing upstream oil and gas assets From a global perspective there appear to be few financing problems in the upstream oil sector. In the period 1991-95, investments in exploration, development and production averaged about $ 80 billion per year world-wide and this figure is expected to increase to about $100 billion in the period 1995-2000. The fact that oil is an international commodity with a sophisticated market support mechanism eases the risk sharing and financing process, however, there exist some issues related to the limited access of international oil companies to domestic markets, due to political considerations and a heavy reliance on national state companies

**Table 6.2 Reform indicators in the upstream oil and gas sectors in South Asia**

| Reform step | % of maximum |
|---|---|
| Corporatization | 33 |
| Law | 67 |
| Deregulation | 33 |
| Restructuring | 100 |
| Concessions | 67 |
| Privatization | 0 |
| Aggregate reform indicator | 50 |

*Source* World Bank, 1999

The enthusiasm for privatization of refining has been much less than that for privatization of power generation (Table 6 3) In the downstream wholesale and retail oil sector, the level of privatization is very low (Table 6.4), however, this is being considered as a strategic sector that the government is willing to divest itself of

**Table 6.3 Reform indicators in the downstream oil (refining) sector in South Asia**

| Reform step | % of maximum |
|---|---|
| Corporatization | 67 |
| Investment | 33 |
| Privatization | 33 |
| Aggregate reform indicator | 44 |

*Source:* World Bank, 1999

**Table 6.4 Reform indicators in the downstream oil (wholesale and retail) sector in South Asia**

| Reform step | % of maximum |
|---|---|
| Corporatization | 60 |
| Privatization | 20 |
| Free prices | 0 |
| Aggregate reform indicator | 27 |

*Source:* World Bank, 1999

The demand for natural gas is expected to grow dramatically in South Asia While the world supplies are estimated to be more than adequate, infrastructure for distribution, requires capital intensive delivery systems either in the form of pipelines or LNG facilities The World Energy Council has estimated a cumulative investment ranging between $ 900 billion to $ 2600 billion worldwide, in the period 1990-2020 However, assured supplies to the consumer (predominantly to the power sector) are necessary for the investments to become economically viable In addition, in case the government is responsible for financing both the power and gas infrastructure, there may be problems in raising adequate public finance, thereby necessitating private sector investment The reform indicators for the downstream gas sector are provided in Table 6.5

**Table 6.5 Reform indicators in the downstream gas sector in South Asia**

| Reform step | % of maximum |
|---|---|
| Corporatization | 100 |
| Law | 67 |
| Deregulation | 33 |
| Restructuring | 67 |
| Investment | 33 |
| Privatization | 0 |
| Aggregate reform indicator | 50 |

*Source* World Bank, 1999

Coal production in the region is largely confined to India, where the public monopoly dominates production and distribution Given the importance of coal as a primary fuel, a high priority will have to be given to financing production, while addressing the issues of inefficiency and environmental concerns In order to increase private investment in the coal sector it is necessary to (i) increase the price of electricity so that the power utilities are able to pay for the coal and the incremental costs in improving and adding capacity, (ii) evolve a more efficient institutional mechanism (iii) encourage integration of the transport, power and industrial sector policies, thereby increasing efficiency

The power sector is highly capital intensive and therefore a rigorous financial and economic evaluation of projects is critical for achieving economic efficiency. Recent studies, indicate an investment requirement of $ 152 billion per annum or $ 2620 billion cumulatively, for a capacity addition of 1200 GW world-wide, in the period 1995-2010, of which generation projects are expected to account for 63% of the capital requirements, transmission 8 8% and distribution 21 2% and the remaining 7% is expected to be directed towards expenditure on telecommunications and related activities. It is estimated that developing countries will account for 58% of these investments, with South Asia alone accounting for $ 278 billion, with a proposed capacity addition of 122 GW in the period 1995-2010 (WEC, 1999). The reform indicators for the power sector are provided in Table 6 6.

**Table 6.6 Reform indicators in the power sector in South Asia**

| Reform step | % of maximum |
|---|---|
| Corporatization | 40 |
| Law | 40 |
| Regulation | 40 |
| IPPs | 100 |
| Restructuring | 40 |
| Generation assets divested | 40 |
| Distribution assets divested | 20 |
| Reform indicator | 50 |

*Source.* World Bank, 1999

## 6.4 Private sector financing in the power sector

Across the countries in South Asia, efforts have been made to introduce private financing of power projects while maintaining the state monopoly in the central position. One of the innovative methods for financing is the Build-Operate-Transfer (BOT) scheme that involves the building of a plant by a foreign investor who operates it for a prescribed period of time and then transfers it to the host company This mechanism for foreign investment has gained popularity in most countries in South Asia and efforts are underway in Pakistan to encourage private investment in the construction of power plants based on the BOT principle (World Bank, 1998). These schemes however, have had limited success since the state monopolies remain the only purchaser of power and the owners of the new capacity lack direct access to consumers, thereby necessitating the government to underwrite the performance of the monopoly

Following the success of the Independent Power Producers (IPPs) in the US, some countries, including India and Pakistan, have introduced incentives to encourage IPPs in the capacity addition projects One of the main problems associated with IPPs is the lack of credit worthiness of the utility contracting to purchase the power and therefore the providers of debt financing are unwilling to lend without an assurance from the government

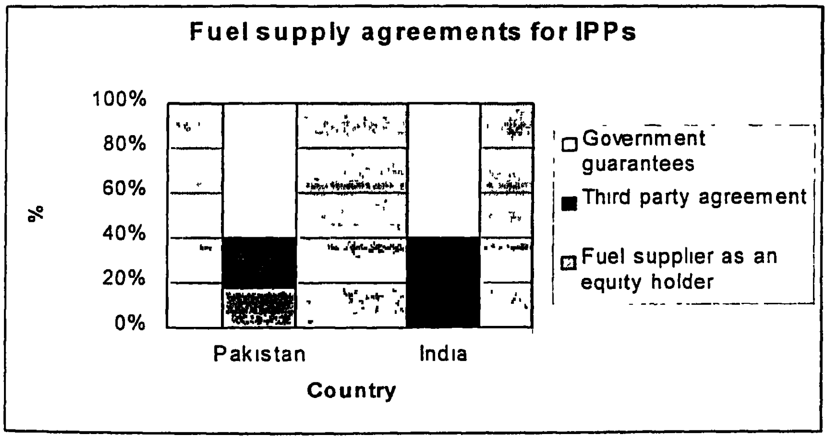
Nevertheless, IPP projects have been an important mechanism for private sector investment in the power generation sector In the period 1992-97, IPPs comprised 137 projects with a capacity of 67 GW at an estimated investment of $ 65 billion, worldwide Of the total investment requirements, $ 51billion was raised from private sector funds, and the balance consisted of guarantees or credit enhancements from multilateral development banks, export credit agencies and bilateral donors Asia has the largest share of IPPs, with 103 contracts worth $ 54 billion In South Asia, IPPs are concentrated in India and Pakistan, which accounted for 8% and 7% of the total IPP investment in developing countries in 1997, respectively

Some of the issues that need to be examined in the context of South Asia are

*Meeting capacity shortages* In most cases IPPs have reduced shortages, which could cost the developing countries as much as $ 1000 million/MWh In the case of Pakistan, IPPs have added about 1000 MW of capacity based on imported fuels

*Transferring of risk to the private sector:* According a World Bank report, an analysis of the impact of IPPs shows that a significant share of the project risk has been transferred to the private sector. IPPs have accepted construction and operating risks, and they share the fuel availability risks for 52% of the IPP market by signing third-party agreements and enlisting the fuel supplier as an equity holder. Most IPPs are compensated for fuel price variations and recovery of their fixed costs is protected against market risks, by take or pay contracts or capacity charges. IPPs are also protected against political risks, through explicit government guarantees

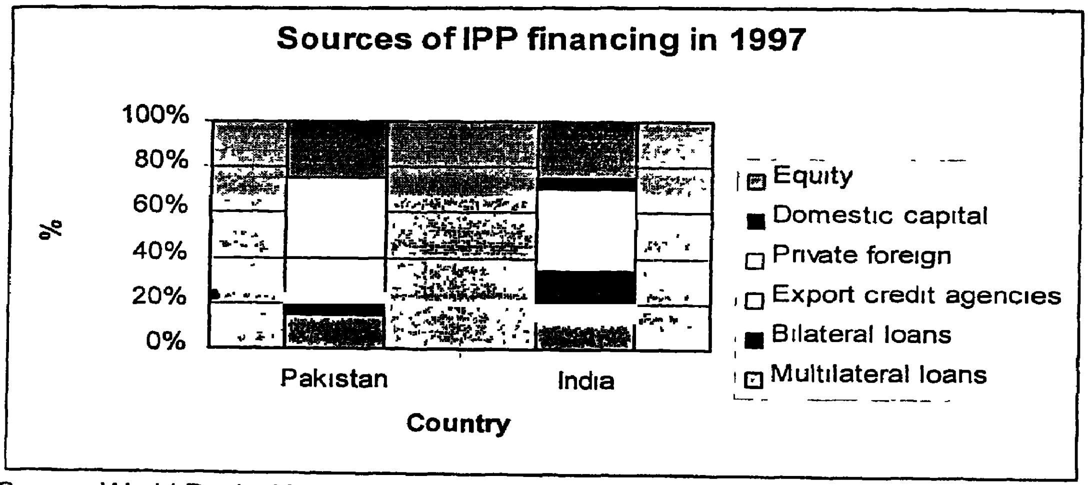
**Figure 6.3 Fuel supply agreements for IPPs**



*Source* World Bank, 1998

*Exposure to foreign exchange risks* IPP projects have an average debt-equity ratio of 76 24 and at present the local capital markets provide a very limited share of the debt finance In contrast, in the case of the state-owned utilities the internally generated revenue has accounted for 25%-40% of the investment funding As with most state-owned utilities, the IPP's debts are borrowed from a small pool of banks that face limits on exposure to clients, sectors and countries Moreover, IPPs rely heavily on fossil fuels, with imported petroleum-based fuels accounting for about 11% of the capacity addition, or 50%-70% of the total operating costs. Even in the case of Pakistan, which has large indigenous gas and hydro resources about 74% of the IPPs are based on imported petroleum products. It can therefore be said that foreign exchange risks have remained the same or perhaps increased with IPPs In the case of Pakistan, which has a large IPP program the foreign exchange risk has infact increased.

**Figure 6.4 Sources of IPP financing in 1997**



*Source* World Bank, 1998

*Price of electricity* With the opening of the market to IPPs, there has been a reduction in the capital cost subsidies in the power generation sector IPPs finance most of their debt on commercial terms with a short period for loan maturity (usually 8 to 12 years), and high interest rates In contrast, state-owned utilities often take long term loans or refinance at subsidized interests, with government guarantees Also, the cost reflected in the tariff charged by the state-owned utility is often only a fraction of what a regulator would allow in a free-market economy In addition, PPAs often include a take-or-pay agreement- a costly straight jacket approach even when demand for the plant output is weak In the final analysis, IPPs will need to increase the supply price for the utility

*Institutional reform* In theory IPPs could strengthen the power sector through competition, technology transfer and the introduction of greater transparency and flexibility With commissioned IPPs accounting for 5%-60% of the peak demand, the monopoly enjoyed by the state-owned utilities has been broken, thus creating an important entry point for the private sector, and in some cases the first feasible step towards liberalization and reform of the power sector Most IPP contracts are based on the either the

BOO or BOT principle In structuring these contracts the government and the utilities have gained some experience with private investors, and the financial procedures Legal frameworks, insurance systems and accounting rules have also been modernized and amended as a result of the privatization process

Finally, it can be said that the development of IPPs in some instances has been affected by the following factors

- Unclear and onerous rules for solicitation, award, and closure of contracts Moreover, the laws and statutes in most cases are out-dated and need to be revised
- The Asian economic crisis created some problems as in the case of Pakistan, related to exchange rates on the basis of which payments were to be made under the long-term PPAs However, India escaped the worst of the economic crisis and the development of IPPs has continued though at a slower pace,
- Change in governments and political upheavals has created the need for repeated approvals, which is often a time consuming and tedious process
- There exists a large differential in the prices across the consuming sectors, making the price of power uneconomical, and the state-owned utilities financially insolvent because of their inability to charge cost-reflective tariffs,
- The government's policy of providing guarantees is limited to only a few fast track projects, thereby necessitating the development of an alternative mechanism that is agreeable to the international financiers Although, bilateral and multilateral agencies have been willing to finance projects without central government guarantees, they have generally not, to date, assumed direct risk and the projects are usually backed by guarantees from local institutions and banks,
- Even though, the escrow[1] mechanism in conjunction with the letters of credit and the state government guarantees addresses the issues of creditworthiness of the utilities There exist problems relating to the effectiveness of this arrangement, and the drawing rights before a default,
- The IPPs claim that they are being penalized by a discriminatory tax and duty structure, as IPPs of projects less than 1000 MW capacity would still have to pay a 10%-25% customs duty on the

---

[1] Under the escrow arrangement, the SEBs allocate and grant security over a percentage of it revenues from the LT and HT consumers to the IPPs A certain amount of these revenues is allocated to an escrow account, over which the SEB has drawing rights until specified events occur

equipment imports, and enjoy a 5 year tax holiday compared to 10 years for their larger producers in the case of India. Overall the smaller IPPs would be paying about 18% more in taxes than their larger competitors

- PPAs have greatly hampered efficiency in system operations as they do not provide any incentive to maximize the availability of base load IPPs in the period when the supply costs are high, and
- In the long run PPA prices and contractual rigidities may prove costly and the IPPs may lose out to technical progress and access to cheaper gas or hydro-power, and even captive power plants in the case of the industrial sector

References

1 WEC 1999 Financing of the Energy Sector in Developing Countries World Energy Council New Delhi

2 World Bank 1997 *Private Capital flows to developing countries the road to financial integration* World Bank and The International Bank for Reconstruction and Development. Washington DC

3 World Bank 1998 Public Policy Paper *The impact of IPPs in developing countries-out of the crisis and into the future* Note no 162 World Bank Washington DC

4 World Bank 1999 Public Policy Paper *A scorecard for energy reform in developing countries* World Bank Washington D C

# Chapter 7: Energy policy in India

## 7.1 Coal

In a liberalized economy, competition is the guiding factor for a reliable product and service. Currently, 98% of the coal is produced from national coal companies, of which 88% is produced by Coal India Limited (CIL) and 10% by Singareni Collieries and Coalfields Limited (SCCL). As such there is no competition in the industry and it is therefore necessary to inculcate the spirit of competition

Private sector participation needs to be facilitated so as to bring about competition amongst the coal producers and hence prevent cartelization for price control It is imperative to bring about the necessary legislative changes to facilitate private sector participation in coal production and distribution Even though some changes have been initiated, efforts are required to further streamline the administrative procedures to expedite the necessary clearances and the required legislative changes (Sengupta S, 1999)

Furthermore, delays in new projects due to paucity of funds may be reduced by forming joint ventures between the public and private sector coal companies and the concerned state government This will not only aid the resolution of procedural difficulties in project implementation but also overcome problems related to land acquisition, rehabilitation of land oustees and forest clearances

Joint ventures will also bring in consumer satisfaction with regard to quality and assured supply of coal Some of the IPPs for instance, have the resources to develop mines, however they may not have the expertise, in which case they may enter into equity participation with the existing coal companies. Similarly public sector utilities, such as the National Thermal Power Corporation, may enter into equity participation with the coal producers like the SCCL and the CIL for their proposed pithead power stations. In addition, the Steel Authority of India Limited and other steel producers in the private sector may enter into joint ventures with the CIL for developing new coking coal mines instead of relying on imports for their future requirements

### 7.1.1 Policy for private sector investments

Due to the pre-liberalization structure of the coal industry, with a high degree of concentration of reserves and assets with the nationalized producers, the infrastructural bottlenecks and the statutory and legal barriers the Indian coal sector may not operate under conditions of competitive price setting over the medium term Moreover, the transition from a monopoly to a competitive system requires balancing of the interests of the various participants in the market, which necessitates the need for a regulatory body

Phased liberalization of the coal sector was initiated during the economic reforms in 1992 The initial package of reforms permitted private sector investments only in captive coal mines of selected end-use industries, namely, steel, power, and cement With the exception of Bengal EMTA which produces 2 mt of coal for power generation, production from these projects is yet to materialize Moreover the post reform period witnessed a decline in the production of domestic coal with a growth rate of a little over 4% per year This is lower than the 6% growth achieved during the regime of a regulated coal industry (1975–92) Obviously, the partial deregulation measures did not bring about the expected incremental supply from the private sector In addition, the import of coal, especially non-coking coal, has increased in the post-liberalization period

Faced with the projected increases in demand for coal, the Coal Mines Nationalization Act, 1973, was amended with effect from 9 June 1993 for the operation of captive coal mines by companies engaged in the production of iron and steel and power generation Cement was also notified as an end-use with effect from 15 March 1996 for the purpose of captive coal mining Until now, about 20 blocks have been allotted as captive coal mining blocks

At present, the captive mining system has failed to deliver the increases in coal output that had been anticipated This is mainly a result of the many restrictions imposed on private developers and the numerous clearances that are required from the various government agencies In particular, captive mines are allowed to supply their output to a single captive customer Even if the main customer is unwilling or unable to take the entire output, the captive coal producer cannot sell the coal to alternative consumers In addition, many developers consider the risks involved with the projects to be very high

Considering the importance of the coal and lignite sector in determining an energy strategy for the country and the need for developing these resources, the Planning Commission constituted the Committee on Integrated Coal Policy (CICP) which submitted its report in May 1996 The Committee framed its recommendations on the central premise that a conducive policy environment has to be created for attracting private investments in the coal sector The recommendations, therefore, seek to (i) augment coal and lignite production through private sector participation, (ii) deregulate coal prices, (iii) conserve coal through reduction of specific consumption in power generation and steel making, (iv) augment transport infrastructure, (v) create a regulatory authority for resolving price disputes and (vi) amend various acts for facilitating the implementation of these recommendations (Planning Commission 1996a)

The following recommendations have been accepted, in principle, by the Government of India (Planning Commision 1999)

- Setting up an independent body to monitor the detailed and regional exploration of coal and lignite resources
- Allocation of new coal mining blocks on the basis of a competitive bidding process in which Indian companies including national coal companies may participate
- Subject to legislative approval, permission to any Indian company to mine coal without the restriction of captive consumption
- Introduction of total decontrol of prices and linkages for coal from 1 January 2000
- Grading and pricing of non-coking coal on gross calorific value basis rather than useful heat value in line with international practices.
- Negotiating for the fuel supply agreement for supplying coal to over 20 IPPs (independent power producers)
- Establishment of a regulatory body, which would perform an appellate function to resolve any price disputes between the producers and consumers
- Amendments to various laws and statutes for the implementation of these recommendations

### 7.1.2 Pricing policy

The Eighth Five-Year Plan (1992-97) envisaged the coal industry to be financially viable and self-supporting through improvements in efficiency and productivity. The decontrol of price was proposed to increase the generation of resources internally thereby reducing the reliance on the budgetary support The government also approved capital restructuring for the SCCL and the CIL during this period However, due to delays in revising coal prices, prior to the decontrol of certain grades of coal, the benefits of capital restructuring have been diluted

Following the recommendations of the Bureau of Industrial Costs and Prices (BICP), a decision was taken by the government to deregulate the prices of coking coal and superior grades (A, B, C grades) of non-coking coal Accordingly, prices of these grades have been deregulated vide notification dated 22 March 1996 Prices of deregulated coking coal and superior grades of non-coking coal have been revised by the CIL with effect from 31 March 1996

On 11 February 1997, the government decided to deregulate the price of 'D' grade non-coking coal, hard coke, and soft coke with immediate effect It also allowed the CIL and the SCCL to fix the prices of the lower E, F, and G grades (power grade) of non-coking coal once every six months by updating the cost indices as per the escalation formula contained in the 1987 report of the BICP, till 1 January 2000 Thereafter, the prices of lower grades of non-coking coal will be fixed by the CIL and the SCCL according to market prices The distribution of these coals will also be deregulated with effect from 1 January 2000 (MoC, 1999)

Regional prices of coal have started emerging as a result of the recent revision in the pricing mechanism This implies that the price of the same grade of coal is not the same for all the coalfields any more This is clearly a precursor to the total decontrol of prices and linkages Deregulation of coal prices is also expected to change the economics of coal projects as the government approved coal projects for a lower rate of return (RoR) of 12% in the larger economic interest of the country, prior to the deregulation of coal prices However, in view of the mounting losses of the coal companies, the Ministry of Coal has decided not to consider any projects for approval with less than 16% RoR This has resulted in the shelving of several coal projects, leading to an unwelcome trend in the demand-supply mismatch Since coal projects have a long gestation period and therefore cannot be executed in a short span, the recommendation of the CICP, regarding negotiating prices for any coal produced from the new coal mines is highly beneficial The selling price of coal from these projects needs to be worked out through commercial agreements between the producer and the consumer so as to yield the required RoR.

### 7.1.3 Fiscal policy

Imports of coal are being allowed under the Open Generalized License The basic import tariff or customs duty on coking coal is 3%, whereas that on non-coking coal has been reduced to 10% The additional duty on coking and non-coking coal has been fixed at 5%

The main features of the proposed fiscal reforms in the coal sector are listed below.

- Allows mining and sale of coal at market-determined prices by private companies
- Allows foreign investors to hold equity in Indian companies in the coal sector or float 100% subsidiaries for mining and exploration ventures
- Foreign equity participation exceeding 50% will be subject to approval by the Foreign Investment Promotion Board (FIPB) and will have to be registered with the Registrar of Companies

### 7.1.4 Legislative reforms

Coal exploration and mining in India is governed by the Mines Act, 1952, Mines and Minerals (Regulation and Development) Act, 1957; Coal Mines Regulation Act, 1957, Coal Mine (Nationalization) Act, 1973, Forest Conservation Act, 1980, and Environment Protection Act, 1986 Opening of new mines and subsequent operations require statutory permission from the Ministry of Coal, the Director General of Mine Safety, the Ministry of Environment and Forests, the State Pollution Control Board and the respective state governments

A mining lease which allows for the development and exploitation of coal needs to be obtained before undertaking any mining operations. It is granted by the State government after it is approved by the Government of India under Mines and Minerals (Regulations and Development) Act, 1957. Mining leases are granted for 30 years initially and can be renewed for a period of 20 years with the government's approval. The lease is ordinarily subject to a ceiling of 10 square kilometres of area.

The legal and regulatory framework needs to reflect the policy of the Government Coal mining projects in India are required to address environmental and social issues The Environment Action Plan, Rehabilitation Action Plan, and Indigenous People's Development Plan are now an integral part of any coal project.

The revision of the legislative framework, however, has not kept pace with the evolving policy that aims towards reducing the role of the government as a developer of resources The legislative provisions, therefore, need to operate within a framework, which is beneficial for the investors and provides accessibility to latest technologies in the coal industry

### 7.1.5 Environmental considerations

Majority of non-coking coal reserves in India occur in thick interbanded seams and are of inferior quality In response to the poor quality of non-coking coal received by the power stations, which leads to the critical problem of fly ash disposal, the Ministry of Environment and Forests issued a Gazette Notification dated 19 September 1997, ensuring clean coal (34% ash content) supply to all power houses located beyond 1000 km of the coalfields and to those located in critically polluted, sensitive and urban areas with effect from 1 June 2001 Currently, about 37% (100 MT) of non-coking coal is transported to power plants beyond a distance of 1000 km of the coalfields Furthermore, under the current proposal, there would be a phased introduction of maximum 34% ash in power station feed between 2000 and 2004 with all new generating capacity constructed after June 2000 designed to use this fuel

Despite long-term targets for the construction of about 60 mt a year washing capacity for non-coking coal, the construction of washing plants has not kept pace with the increasing coal-mining capacity As a result, large quantities of unwashed coal are being transported to power stations placing a severe constraint on the country's bulk freight services' capacity

In view of the CIL's policy of not setting up any washery of its own other than on build-own-operate (BOO) or build-own-operate-transfer (BOOT) basis and the large costs and gestation period involved, the Coal Mines Nationalization Act, 1973, was amended and about 20 mt of capacity is under construction/planning with the private sector. The Government of Andhra Pradesh also selected this route for providing washed coal from the SCCL's mines with a call for BOO tenders for the construction of three 8000 tonnes per day washeries at Manguru, Rudrampur, and Yellandu (TERI, 1999). The progress, however, has been very slow

### 7.1.6 Augmentation of transport infrastructure

With much of the coal production in the eastern part of the country, and consumers such as power stations and steel works located elsewhere, transport becomes a major consideration. Rail is the main mode of coal transport in India, followed by captive systems such as merry-go-rounds Road transport, conveyors, and aerial ropeways are also used. Sea-borne movements account for about 6% of India's domestic coal transport Coastal shipment is used for supplying coal to consumers in southern India

The share of the railways for coal transportation has decreased over the years While the production of coal increased by approximately 5 6% annually, the rail movement increased at 3 8% only The constraints on the rail evacuation facility have resulted in significant pithead stocks Movement by rail has been observed to be constrained particularly in areas like Korba, Talcher, Ib Valley, North Karanpura, and Rajmahal, which have large potential for production

India has 11 major ports that are managed by the Port Trust of India, under the jurisdiction of the central government A significant quantity of coal (currently about 11 mt/y) is carried by rail over relatively short distances to the eastern ports for onward coastal shipping to southern India Haldia, Paradip, and Vishakapatnam are the most important ports on India's eastern coast Around 10–11 mt of coal is shipped out of these ports each year, destined mainly for the southern ports of Chennai and Tuticorn. Coking coal imports are also received at these ports It was envisaged that the coal movement from the eastern region to the power plants in the southern and western regions would be based on a carefully drawn-up action plan necessitating the movement of coal by coastal shipping, thereby easing the pressure on the railways.

The government has recently allowed private sector participation in the development and augmentation of port facilities Large users such as power generators, steel manufacturers, and cement producers are also being encouraged to develop their own coal handling facilities.

## 7.2 Oil

### 7.2.1 New Exploration Licensing Policy

The Accelerated Programme for Exploration, formulated during the Eighth Plan period aimed at the development of a national seismic grid and exploration in the frontier areas and deep waters The Eighth Plan outlay for the oil and gas sector was also enhanced to Rs 238 755 billion as compared to160 76 billion during the Seventh Plan period Apart from one major discovery made by the ONGC in the Krishna-Godavari Basin in the Bay of Bengal, resulting in the flow of 3600 b/d of crude oil and 41000 cubic metres/d of gas Efforts to achieve the reserve accretion targets have not been satisfactory This, among other factors, redirected the attention towards supplementing exploration activities through private sector involvement

In the ninth bidding round held in 1995, also known as the joint-venture round, efforts were made to reduce the risk for private investors by associating the national oil companies (NOCs), Oil and Natural Gas Commission (ONGC) and Oil India Limited (OIL) as partners in these ventures It was also proposed that exploration be prioritized according to the geophysical merit of the basins and not according to their categorization based on the degree of success The new strategy entailed the identification of prospects in old fields/basins (Category I) using new technology and updated database, and focus exploration in western and north-eastern onland basins like the Mesozoic section of Cambay, Kachch, Saurashtra, Rajasthan, and areas of uncertain prospects such as the Deccan plateau (TERI, 1999)

The result of these efforts led to the award of 35 exploration blocks and 30 discovered fields to the private sector Work is already in progress in 22 exploration blocks and contracts for some more blocks are expected to be signed soon In addition, 5 medium and 13 small fields are under development, some of which are already producing oil and gas So far the total investment brought into the sector, mostly in the producing fields, exceeds $ 1 billion The crude oil production from these fields has increased over the years, however, bulk of the reserve accretion has taken place around the previously discovered fields and no new areas are being explored

A number of reasons, including the rigid decision-making structures of the NOCs, as listed below, reduced the attractiveness of this innovation and can be attributed to the disappointing results (Desai, R N, 1999)

- There was a general perception that the blocks with high prospects were reserved for the NOCs and only the high-risk blocks were offered to the private investors
- The seismic data provided was inadequate in addition to being old and expensive, in some cases
- The NOCs continued to hold on to the blocks they were awarded on a nomination basis and also played a decisive role in the delineation of the blocks.
- Even though it had been recommended that where feasible, an exploration block should include a producing field or an area with oil/gas finds, there were instances where this was not done and the producing areas were deliberately not included in the blocks that were offered for exploration
- The delay in awarding the production sharing contracts (PSCs) was an important factor contributing to the limited success of the exploration policy, as even though the PSCs provided for crude oil/gas agreements to be finalized within 90 days, only one such agreement has been signed in the last three to four years. This led to an ad hoc arrangement to buy and sell oil and gas from these fields, resulting in a delay in cost recovery

These factors contributed significantly to reducing the commercial attractiveness of the blocks offered for exploration The New Exploration Licensing Policy (NELP) introduced in 1999, seeks to eliminate most of the problems mentioned in the preceding paragraph It proposes to change the procedure for the new contracts It does not however, address the problems associated with the PSCs already issued by the Government. Altogether 48 exploration blocks, 26 offshore up to 400m isobath, 12 deep offshore off the east coast beyond 400 m isobath and 10 onland blocks have been identified for NELP. The new policy has an improved fiscal package to offer which is expected to attract all the investors and a Petroleum Tax Guide has been compiled to facilitate the bidders understand the economic and financial implications Furthermore, the model PSC will reduce the time taken for contract negotiations Therefore, it can be said that the new policy is a step towards providing a level playing field for the private investors and the NOCs. The NOCs would now have to compete with others for acreage rather than get them through nominations.

Some of the positive features of the NELP are outlined below:

- The option of a seismic survey in the first phase of the exploration period
- There is no carried or participating interests of the NOCs and therefore, the profits of the contractor are not further reduced after sharing with the government
- NOCs will also bid for the blocks outside the area that has already been allocated to them The contract will, therefore, be between the company (ies) and the government
- A high-level inter-ministerial group has been formulated to expedite the finalizing and signing of PSCs
- The evaluation criteria for award of a block has been made more transparent than before
- The exploration period can be of eight years as against the seven years in the pre-NELP system.
- There is no minimum expenditure commitment in the exploration period
- Equipment imports for exploration and production have been exempted from customs duty
- Option to amortize exploration and drilling expenditure over a period of 10 years from the time of commercial production
- In view of the infrastructure status given to the upstream petroleum sector, the contractor will enjoy an income tax holiday for 7 years from the date of commencing commercial production This is an additional benefit to that already available for exemption from income tax till 100% cost recovery,
- Royalty for onshore areas is payable at the rate of 12 25% for oil and 10% for natural gas, and for offshore areas at the rate of 10% for both oil and natural gas The royalty for deep

water areas beyond the 400m isobath line is charged at half the rate applicable for offshore areas for the first 7 years of production,

- To facilitate the bidders understand the economic and financial implications, a Petroleum Tax Guide has been prepared
- There is an option to sell oil and gas in the domestic market;

The MoPNG received a total of 45 bids for exploration in 27 of the 48 blocks on offer The bidders included 10 foreign companies including Enron, Petronas, OAO, Gazprom, Cairn Energy, South Oil and Gas etc, and six private Indian companies ONGC and Reliance Petroleum Limited emerged as the largest bidders While RPL had bid for 14 blocks located in the offshore Bombay, Kerala-Konkan basin, Kutch, and the Krishna Godavari Basin, in partnership with Nyco Resources of Canada, ONGC had bid for 15 blocks (Petroleum Economist, 1999). The response to the NELP has been widely predicated as lukewarm in view of the collapse of the government in July 1999

With the country importing about 70% of the crude oil requirements, the award of 25 exploration blocks under the NELP, including 7 deep-water offshore blocks, 16 shallow water offshore blocks and two inland blocks is an important step to boost indigenous production, thereby reducing oil import dependency The total investments for the development of these blocks is estimated at $250 million The government also plans to invite bids for 35 blocks under the second round of the NELP, including deep-water blocks on the western coast and blocks for coal-bed methane In view of the NELP, crude production is expected to increase from 34 mt in 1997/98 to about 37 mt by the year 2001/02 (Planning Commission 1999)

### 7.2.2 Policy for private sector participation in refining

The Sub-group on Refining for the Ninth Five Year Plan had suggested certain financial incentives for the efficient functioning and enhancing private sector participation in the refining sector during the Ninth Plan period. Consequently, the refining sector was delicensed in June 1998 and the public sector oil companies were allowed to form joint ventures with an equity participation of 26%. More recently, the Sengupta Committee was formulated to analyse the future trends in the Indian refining sector in the context of plans to deregulate the industry, improve competitiveness, boost refining capacity through private sector participation.

The total refining capacity is 67.5 million tonnes per annum (mtpa) at present and is expected to increase to 93.2 mtpa by the year 2001/02 (Planning Commission 1999) due to refining capacity addition by public sector undertakings (PSUs), joint ventures, and private sector units, and expansion of existing refineries

Reliance Petroleum Limited started operations of its 27 mt/y refinery at Jamnagar in July 1999 The refinery is India's largest, with an initial output of 135,000 tonnes/month of diesel and 10,000 tonnes/month of kerosene it has contributed significantly in meeting the diesel requirements in the country. The Bina refinery a joint venture of BPCL and Oman Oil Company which was expected to add 6 mt/y has been stalled due to problems related to environmental clearances Refining capacity additions are also expected from the projects listed below, however the time of commissioning of these projects is still uncertain

- ONGC is planning to acquire a 10% stake in IOC's 9mt/y refinery project in Paradip, in exchange IOC would pick up a 10% stake in ONGC's upstream actvities,
- MRL is planning to set-up a refinery with a capacity of 9 mt/y as a joint venture with the IOC in Nagapatanam; and
- HPCL is also planning to set-up a joint-venture 9 mt/y refinery in Punjab for which it has invited bids from international parties

The refinery-wise capacity addition till the end of the Xth Plan period is provided in Table 7.1 The expected increase in refining capacity would be sufficient to meet the growth in product demand (105 mtpa by the end of the Ninth Plan) with a minimum level of petroleum product imports, estimated to reduce from 25 mt in 1998/99 to about 10 mt in 1999/2000 RPL has infact, entered the international market for exporting motor spirit and naphtha The cargoes of 36,000 tonnes and 30,000 tonnes of MS have been sold to Shell International's trading arm Stasco The company however, stands to lose about 10 crore in each deal compared to what it would have earned in selling the MS in the domestic market This is due to the fact that MS attracts a 30% import duty, hence companies selling the MS in the domestic market have an advantage of tax savings over the exporters. The issue of export losses has been in focus because private refiners with new capacities are expected to produce a surplus of MS, naphtha and diesel Though the refiners have asked for the oil pool to absorb the export losses, the government has yet to take a decision on the issue There are however, benefits accruing from product exports. These include advance licensing benefits and duty-free crude oil imports at competitive prices.

**Table 7.1 Existing operating capacities and expected expansion (Million tonne per annum)**

| Refinery | 1998/99 | 1999/00 | 2000/01 | 2001/02 | 2006/07 |
|---|---|---|---|---|---|
| BPCL, Mumbai | 8.8 | 9 | 9 | 9 | 9 |
| HPCL, Mumbai | 5.3 | 5.9 | 5.9 | 5.9 | 5.9 |
| HPCL, Vizag | 3.9 | 6 | 7.5 | 7.5 | 7.5 |
| IOC, Koyali | 10.9 | 10.9 | 12.5 | 13.7 | 13.7 |
| IOC, Mathura | 8.9 | 9 | 9 | 9 | 9 |
| IOC, Panipat | 2.2 | 4.3 | 6 | 6 | 12 |
| IOC, Barauni | 2.2 | 3.3 | 4.2 | 6 | 6 |
| IOC, Haldia | 4.7 | 4.7 | 4.7 | 5 | 5 |
| IOC, Guwahati | 0.8 | 0.9 | 1 | 1 | 1 |
| IOC, Digboi | 0.5 | 0.6 | 0.7 | 0.7 | 0.7 |
| BRPL | 1.7 | 2 | 2.4 | 2.4 | 2.4 |
| Numaligarh | 0 | 1.6 | 3 | 3 | 3 |
| MRL, Manali | 6.1 | 6.5 | 6.5 | 6.5 | 9.5 |
| MRL, Narimanam | 0.6 | 0.7 | 0.7 | 0.7 | 1 |
| CRL | 7.8 | 7.8 | 7.8 | 7.8 | 13.5 |
| MRPL | 4.1 | 5 | 9 | 9 | 9 |
| RPL, Jamnagar* | _ | 24 | 27 | 27 | 27 |
| Essar, Vadinar* | _ | _ | _ | 10.5 | 12 |
| BPCL, Bina | _ | _ | _ | _ | 6 |
| HPCL, Bhatinda | _ | _ | _ | _ | 9 |
| IOC, Paradeep | _ | _ | _ | _ | 9 |
| NFCL, Cuaddalore | _ | _ | _ | _ | 6 |
| Total | 68.5 | 102.2 | 116.9 | 130.7 | 177.2 |

*Source* TERI estimates

*private refineries

### 7.2.3 Environmental concerns for refineries

Emissions from refineries account for about 7% of the total emissions from the production and consumption of petroleum products The effluents generated in a refinery can be classified as (1) liquid effluents (2) gaseous effluents (3) oily sludge. Compliance with the prescribed minimum national standards (MINAS) with regard to liquid and gaseous effluents is a statutory requirement Refineries in the country are therefore required to be equipped with adequate pollution control facilities, which need to be upgraded and reviewed from time to time

The liquid effluents are generated when the water gets contaminated with oil and other pollutants and have to be treated before discharge The government has prescribed MINAS for liquid effluents with respect to critical parameters such as oil and grease, phenols, sulphides, biochemical oxygen demand, and total suspended solids MINAS specifies the quantum of discharge of these pollutants in terms of crude throughput All the refineries in the country are equipped with full-fledged effluent treatment plants, comprising physical, chemical and biological processes The treated wastewater is reported to meet the standards in all the refineries.

Sulphur dioxide ($SO_2$) is the primary gaseous effluent, for which the government has prescribed MINAS in terms of $SO_2$ emissions per tonne of feed processed (Table 7 2) The stipulation for boilers is in terms of minimum stack height to minimize the ground-level concentrations.

**Table 7.2 Emission standards for $SO_2$ in refineries**

| Process | Emission limit |
|---|---|
| Distillation (atmospheric+vacuum) | 0 25 kg/MT of feed* |
| Catalytic cracker | 2 5 kg/MT of feed* |
| Sulphur recovery unit | 120 kg/MT of sulphur in the feed* |

*feed for that part of the process only

*Source* TERI (1998)

Some of the measures adopted by the refineries for controlling $SO_2$ emissions include (1) the use of low sulphur crude oil, (2) desulphurization of refinery fuel gas, (3) advance process control systems, (4) adoption of energy conservation measures, thereby reducing fuel consumption, (5) and higher stacks for better dispersion of gases

Refineries have also adopted various techniques, such as installation of improved mixers for reducing the formation of oily sludge in the crude storage tanks and use of chemicals for recovery of oil from the tank bottom sludge In some refineries like BPCL and HPCL-Mumbai, the sludge is sold to micro-crystalline wax manufacturers while in IOC's refinery at Mathura the sludge is treated with micro-organisms.

The IOC-Mathura refinery was the first to receive ISO-14001 accreditation in July 1996 followed by other refineries namely, IOC-Guwahati, Barauni, Gujarat, Haldia and Digboi and BPCL-Mumbai In other refineries efforts are underway to conform to this International Environment Management System (MoPNG 1999a).

#### *7.2.3.1 Product quality standards*

In view of the current environmental standards, the content of harmful chemicals such as lead, benzene, sulphur, and aromatics in petroleum products needs to be reduced The emission norms for petrole and diesel vehicles are provided in Tables 7 3 and 7.4

**Table 7.3 Emission standards for petrol vehicles as on 1 April 2000 (Gram per kilometre)**

| | Carbon monoxide | Hydrocarbons | Oxides of Nitrogen |
|---|---|---|---|
| 4-wheel passenger vehicle | 2 72 | _ | 0.97 |
| 3-wheelers | 4 | _ | 2 |
| 2- wheelers | 2 | _ | 2 |

*Source* Fuel and Vehicular Technology, Association of Indian Automobile Manufacturers, New Delhi, 1999

**Table 7.4 Emission standards for diesel vehicles as on 1 April 2000 (gm/km)**

| | Carbon monoxide | Hydrocarbons | Oxides of nitrogen | Particulate matter |
|---|---|---|---|---|
| Gross vehicle weight>3 5 tonnes | 4.5 | 1 1 | 8 | 0 4 |
| Gross vehicle weight<3 5 tonnes | 2 72-6 90 | _ | 0 97-1 70 | 0 14-0 25 |

*Source* Fuel and Vehicular Technology, Association of Indian Automobile Manufacturers, New Delhi, 1999

The present status with respect to product quality is as summarized below.

- Reformers have been introduced in refineries to produce low lead MS (motor spirit) which has been introduced throughout the country with effect from 31 December 1996 Unleaded MS with lead content of 0 013 g/litre (max.) has been introduced in the metro cities of Delhi, Calcutta, Mumbai, and Chennai, and also in the city of Agra and the radial routes with effect from 1 April 1995 Unleaded MS has also been introduced in all the state capitals/Union Territories in June 1998 and is proposed to be introduced throughout the country by 31 March 2000.

- The Central Pollution Control Board (CPCB) allows a maximum of five per cent benzene content in MS To meet this specification, while maintaining the existing MS production level, imports worth Rs 1 8 billion/year and additional facilities at a cost of Rs 8 billion would be required It is proposed to reduce the benzene content to three per cent in the metros by the year 2000.
- The Bharat Petroleum Corporation Limited (BPCL) is manufacturing methyl tertiary butyl ether (MTBE) which is used for oxygenating MS, thus facilitating a more complete combustion and boosting the octane value
- The installation of hydro-desulphurization units in refineries is expected to improve the quality of high speed diesel (HSD) by reducing the sulphur content Low sulphur HSD with sulphur content of 0 5% (max.) was introduced in the four metro cities of Delhi, Mumbai, Calcutta, and Chennai, and in the environmentally sensitive area of the Taj Trapezium with effect from 1 April 1996 Low sulphur HSD with a sulphur content of 0 25% was introduced in the Taj Trapezium with effect from 1September 1996 and efforts are underway to introduce the low sulphur diesel throughout the country The IOC has recently constructed diesel desulphurization units in four of its refineries These units will be retrofitted with second stage reactors for a total switch-over to ultra-low sulphur diesel with a sulphur content of 0 05%, which would be made available from 1 April 2000
- With the proposed change in the distillation specification, a loss of about 2 5 mtpa in HSD production is estimated, requiring additional imports worth Rs 7 billion per year
- The cetane number of HSD, which is an indicator of the ignition quality of the fuel, is currently low at a minimum of 42, but efforts are being made to increase it to 48 by 2001/02

Steps are also being taken to improve the quality of fuels used in the industries. The chemical composition of some of these fuels is provided in Table 7 5

**Table 7.5 Chemical composition of fuels used in industry (percent)**

| Fuels | Carbon | Sulphur | Nitrogen | Ash |
|---|---|---|---|---|
| FO (Fuel oil) | 84 | 3 5 | — | 0 5 |
| LDO (Light diesel oil) | 85 | 3 | — | — |
| LSHS (Low sulphur heavy stock) | 86.7 | 1 | — | — |
| LPG (Liquified petroleum gas) | 81 5 | — | — | — |
| Natural gas | 66 | — | — | — |

*Source* TPL(undated)

### 7.2.4 Pricing policy

The APM constituted a cost-plus pricing system for the producers and a cross-subsidization scheme for the end-users The Oil Pool Account, an extra budgetary account, reconciled the interests of the consumers and the producers

The government had appointed a Strategic Planning Group on Restructuring of the Oil Industry ('R Group'), comprising eminent experts from the public and the private sectors, to make recommendations for meeting the policy objectives of the oil industry The details of dismantling the APM and the duty structure for the transition period 1998-2002 were also decided The dismantling of APM came into force on 1 April 1998

According to a study by the National Council for Applied Economic Research (NCAER), the dismantling of APM would result in an overall wholesale price index (WPI) inflation of 1.57% over a five year period on a cumulative basis

Some of the impacts of dismantling of the APM are summarized below (MoPNG1999a)

- The cost-plus formula for Public Sector Oil Producers (PSOPs) has been withdrawn from 1 April, 1998 They are now paid instead, a percentage of the weighted average free on board (FOB) price of actual imports of crude oil for indigenous production However, a floor price of Rs1991/mt has been fixed
- In the transition phase the producers of crude oil shall retain a pre-announced increasing share of FOB cost of crude oil while the refineries will have to pay the import parity price for

crude. The difference will accrue to the Oil Pool Account to discharge the oil bonds Indigenous oil producers will pay oil cess of Rs 900/mt and royalty out of their own proceeds as in the past.

- The cost-plus formula for shipping of crude has been done away with and market- determined prices are to be paid.
- With effect from 1 April, 1998, the refinery gate prices of controlled products, namely, MS, HSD, SKO, LPG, and ATF, are being fixed on the principle of import parity However, existing refineries will contribute towards servicing of oil bonds through adjustment during the transition period Other products of the refineries like naphtha, FO, LSHS, wax, and bitumen, can be sold at market prices
- The ex-storage point prices of MS, HSD, kerosene Public Distribution System (PDS), LPG domestic, ATF, and NGL continue to be determined by the government However, the government proposes to decontrol the price of ATF from April 2000, thereby implying that the oil companies would no longer be guaranteed the 12% rate of return and the airlines would allowed to import the fuel Until now the revenues from ATF sales accruing to the oil pool account were utilized to cross-subsidize products like ATF, kerosene and LPG
- Private and joint venture refineries have been permitted to import crude oil freely effective from 13 July 1998.
- Customs duty on crude oil was reduced from 27% to 22% effective from 2 June 1998 The duty has been further reduced to 20% in April 1999 and 15% in March 2000
- FO has been decanalized with effect from 13 July 1998 under the provisions of the Export-Import Policy Naphtha exports have been decanalized with effect from 8 June 1998
- The refining sector has been delicensed with effect from 8 June 1998
- Freight under recoveries on HSD (difference between actual railway freight and notional railway freight) to the extent of 20% have been passed on in the selling prices effective from 9 January 1999.
- The ex-storage point price of LPG (domestic) has been revised with effect from 1 February 1999 and thereafter on 27 February 1999

- Customs duty on ATF and HSD has been reduced from 30% to 25%, while on LPG it remains unchanged at 15% and 30% for gasoline, furnace oil, bitumen, and superior kerosene oil

The process of liberalization and deregulation is expected to continue during the transition period (1997-2002) Phased reductions in subsidies on kerosene (PDS) and LPG (domestic) are proposed during this period The incidence will be transferred to the budget by the end of the transition period

#### 7.2.4.1 *Pipeline tariffs*

The government had constituted a committee to review the tariff structure for crude and product pipelines The committee has recommended the withdrawal of the cost-plus formula for product pipelines tariffs, and has proposed a two-tier tariff- a higher tariff for shorter links (up to 300 km) and a lower tariff for longer distances For the existing pipelines a tariff of Rs 0.81/ t/ km up to 300 km and Rs 0 77/ t/km for distances over 300 km has been suggested. For pipelines commissioned after 1 April 1998, a tariff of Rs1 20/t/km up to 300 km and Rs1 13/t/km for distances greater than 300 km, has been proposed It is also recommended that the new product pipelines should be allowed a higher tariff for the first three years of their operation and then treated at par with the existing pipelines These tariffs have been proposed only for controlled products with the oil companies are free to fix tariffs for the decontrolled products.

In the case of crude pipelines it is proposed that tariffs should be increased as in the case of product pipelines However the tariff regime does not apply in the case of crude and product pipelines costing less than Rs 1 billion, and the owners were free to set the tariffs on the basis of market forces with a ceiling equal to the rates proposed for the product pipelines

The withdrawal of the cost-plus formula for marketing operations has also been suggested It is proposed that the marketing companies should be compensated according to the average marketing margin, subject to a ceiling of the actual marketing margin

The need for establishing a regulatory authority with jurisdiction over pipelines and related infrastructure has been strongly emphasized The savings from the proposed pricing mechanism is estimated at Rs 11.2 billion that can be used for servicing and amortizing oil bonds.

### *7.2.4.2 Trend in international oil prices*

The low crude oil prices in 1998 brought a welcome relief for India as prices hit a 25-year low at below $10/ barrel. Oil accounts for around one-fifth of the total imports, and despite the low oil prices the trade deficit increased from $ 6.37 billion in 1997/98 to $ 8.25 billion in 1998/99. Driven by oil output cuts of 4.3 billion barrels/day by the Organization of the Petroleum Exporting Countries (OPEC), international crude prices rose from $10 to over $19 per barrel in the period March-September 1999. In March 2000, the crude oil price crossed $30 per barrel, the highest price in nominal terms since the Gulf crisis in 1991. The oil import bill in the period April-December 1999 was $6.9 billion, a 58% increase over the corresponding period in the previous year (Table 7.6). The import bill is expected to further increase to $13.46 billion in the year 2000. An increase in the country's oil refining capacity could, however, ease some of the pressure on the import bill as a higher outlay on crude oil would be offset by lower imports of more expensive petroleum products.

**Table 7.6 Oil import bill**

| Year | Crude oil | Petroleum products | Oil bill (billion $) |
|---|---|---|---|
| 1993/94 | 30.82 | 11.82 | 5.47 |
| 1994/95 | 27.35 | 13.37 | 5.48 |
| 1995/96 | 27.23 | 19.67 | 6.94 |
| 1996/97 | 33.91 | 19.47 | 9.32 |
| 1997/98 | 34.49 | 18.61 | 7.39 |
| 1998/99* | 38 | 19 | 7.5 |
| 1999/2000* | 60 | 9 | 9.8-10 |

*estimates

*Source* Indian Express Newspaper (Bombay Ltd) (18 August 1999)

Revenue on oil import constitutes about 35% of the total customs collection. The Finance Ministry is expected to earn about Rs 30 million more than budgeted from customs duty on oil imports if the international oil prices stabilize at a level $ 19 /barrel. The ONGC and OIL on the other hand are poised for a windfall, due to the increase in oil prices. The state-owned oil exploration and production companies now get a floor price of Rs1991/ tonne for their oil output, equivalent to roughly $ 8/ barrel. On 1 April 1999, the ONGC and the OIL became entitled to

77 5% of the prevailing international crude price, which was roughly $ 12 90 per barrel (at the prevailing price of $ 16 65 a barrel in April 1999) The floor price was based on the last administered price for crude and fixed at a time when crude prices averaged at $ 18 per barrel in the key oil markets around the world The OCC, which now charges international crude prices from the refineries, but pays the ONGC and OIL a fraction of it, is expected to take the continued crude price spurt since March 1999 into cognizance

### 7.2.5 Regulatory reform

The legal framework for regulation of exploration and production of oil and gas is provided by the Oilfields Development and Regulation Act and the Petroleum and Natural Gas Rules. The Act has recently been amended to provide for the introduction of the NELP The terms for offering exploration blocks have now been further liberalized, under the provisions of NELP, 1999 Apart from better terms offered to the bidders, the outstanding feature of the policy is that it offers a level playing field to the NOCs and private operators However, despite the attractive terms, the prospects of the blocks under offer do not seem very high and the speed at which the bids will be processed will depend upon the assistance extended by the Directorate General of Hydrocarbons (DGH) and the Ministry of Petroleum and Natural Gas (MoPNG)

The DGH, was set up in 1993, with the objective of ensuring correct reservoir management practices, reviewing and monitoring exploratory programmes and development plans for NOCs and private companies, and monitoring of production and optimum exploitation of gas fields It is obvious that these functions cannot be effectively executed unless the DGH derives its authority from the law It is, therefore, reported that the government is considering the conversion of the DGH into a statutory authority The DGH needs to combine regulation with promotion of private sector investments in exploration and production so as to provide a single point reference to the private investor.

The downstream sector, comprising the marketing and refining sectors, is regulated mainly by the Indian Petroleum Act and control orders passed by the government under the Essential Commodities Act The OCC under the administrative control of the MoPNG, currently performs the function of a planner, coordinator, advisor, and regulator in the downstream sector However, the Essential Commodities Act has been amended recently, for the effective dismantling of the APM and total decontrol. The amendment would also remove the sector from the control of the Oil Coordination Committee. Even though the government had announced the dismantling of the APM to be completed by April 2002, efforts are underway to complete the process earlier During the dismantling of the APM and after, there will be a need for a statutory regulator to undertake the functions of the OCC for both the public and private sector oil companies till such time as the market becomes fully competitive The government had assigned TERI the task of drafting a legal framework for the regulation of the downstream sector The draft is currently under review by the MoPNG.

The government has opted for a four-year transition period for a fully deregulated and competitive oil industry While it has thrown open the refining sector for private sector participation, the marketing sector is still being controlled substantially Private sector participation in the upstream and downstream sectors is expected to achieve the following objectives

- Bring in additional investments,
- Accelerate the development of infrastructure such as refineries,
- Give the customer a choice of quality products with improved services,
- Provide internationally competitive marketing and distribution management systems thereby improving performance and efficiency

Currently, only those who have invested over Rs 20 billion in refineries or are producing more than 3mt of crude oil are eligible to have marketing outlets for MS and HSD A greater deregulation in the marketing sector has been therefore suggested for the operation of a fully competitive market In addition, a simultaneous opening up of the upstream and downstream sectors may stimulate investments in the refining sector.

The reform structure also needs to incorporate the well-being of the economically backward sections of the society or those living in far-flung areas, who, if deprived of the subsidy on petroleum products, may have to be provided with alternatives

A total decontrol of the downstream sector would imply, (1) free sourcing of crude, (2) independent determination of the crude slate and product pattern, (3) removal of marketing and distribution controls, (4) dismantling of the sales plan entitlement, and (5) decontrol of the refining and marketing margins and reseller commission (Srivastava *et al*,1999) In such a scenario, the role of the regulator would be limited only to (1) monitoring the movement of prices and prevent the formation of cartels, (2) facilitate the supply of petroleum products to all areas of the country, (3) ensure compliance with strategic stockpiling obligations, safety, health and environmental concerns, (4) provide a quasi-judicial dispute settlement mechanism, (5) facilitate the operationalization of government policy, (6) intervene in time of national and international emergencies and (7) collecting data on the oil industry

Apart from the above, regulation would be automatically driven by the forces of competition However, in light of the infrastructural constraints in the import, transportation, refining, and marketing of products, the regulator would need to manage the transition to a fully deregulated industry In this respect, the regulator would be involved with the following activities during the transition period

- Licensing of refineries
- Sourcing of crude imports
- Sourcing of products
- Strategic petroleum reserves
- Refinery production pattern and ex-refinery pricing
- Inland movement of products
- Marketing set-up
- Safety concerns

The regulatory body would therefore meet the objectives of (1) promoting investments (2) removal of barriers to private sector participation (3) prevention of cartelization (4) regulation of prices (5) supervision of transportation and related infrastructure

#### *7.2.5.1 Road map for disinvestment*

The MOPNG has drawn up a 5-year plan for disinvestment in the oil sector. Apart from the resource mobilization that is expected as a result of the disinvestment, it would also create a competitive environment in the oil and gas sectors. The government plans to reduce its stake to 26% in oil companies, other than IOC, ONGC and GAIL, where it would continue to retain a majority stake In the short-term it is proposed to reduce the government's equity to below 51% in at least one refinery HPCL or BPCL. In the medium term the retention of a 26% stake has been recommended to avoid possibilities of asset stripping by the new management In the long-term, beyond three years, it is proposed to reduce the stake in all oil companies except ONGC, IOC and GAIL to negligible levels. This would be necessary to ensure security of supply to remote areas and stability of prices The government may however consider disinvestment in these companies once the market stabilizes.

### 7.2.6 Augmentation of transport infrastructure

The present infrastructure is inadequate to meet the growing demand for petroleum products The new refining capacity needs to be supported by crude pipelines to supply crude to refineries and product pipelines to transport petroleum products to demand centres Also in view of the projected increase in crude imports the port infrastructure needs to be augmented

#### *7.2.6.1 Crude and product pipelines*

At present, there are three crude pipelines one belonging to OIL bringing north-eastern crude to the Barauni refinery and the other two belong to IOC One IOC crude pipeline carries crude from the Gulf of Kachch to Koyali and Mathura refineries and will probably be extended to carry crude to the Panipat refinery, and the other carries crude from the Haldia to Barauni refinery The quantity of north-eastern crude is inadequate to meet the capacity of the refineries at Guwahati, Digboi, Numaligarh and Barauni whose current capacities of 8 4 mt are being expanded to 13 mt by the end of the Ninth Plan It is therefore desirable to augment the 4.23 mt/y Haldia-Barauni crude pipeline to handle imported crude not only for catering to the full capacity of the 6 mt

Barauni refinery (in 2001/02) but also to supply crude to the Bongaigaon and Numaligarh refineries.

While the crude requirements of the proposed joint venture refinery in Uttar Pradesh may be fed through an extension of the Gulf of Kachch-Bina pipeline A new crude pipeline is being proposed from the Gulf of Kachch to Bina for meeting the crude requirements of the new joint venture refinery at Bina The projected joint venture refinery in Bhatinda, Punjab, will also need to draw its crude requirement through a new pipeline from the Gulf of Kachch In all, the Sub-group on Refining has proposed 11 new crude pipelines for enhancing the capacity utilization of the existing refineries These pipelines need to be planned to meet the envisaged requirements and their utilization has been proposed on a contract-carriage basis (Planning Commission, 1997a)

There is considerable scope for improving the efficiency of petroleum product transport system Currently, the bulk of the movement of petroleum products' is through railways followed by transportation through pipelines. The movement of products from coastal refineries along the shoreline is a regular feature, to position products at pivotal port terminals from where rail movement is relatively easier While rail movement has the advantage of using the existing track capacity, it has the limitation of being more energy intensive than pipelines Product losses are also negligible in the case of pipelines This not only reduces the need for tankage at the destination but also brings down the inventory carrying cost It is also possible to provide additional capacity in the pipelines to meet peak requirements more efficiently Therefore, greater emphasis needs to be laid on developing pipelines as the primary mode of inland movement of petroleum products The current pipeline capacity is provided in Table 7 7

**Table 7.7 Existing product pipeline network**

| Pipeline | Capacity (MTPA) Throughput* 1997/98 (MTPA) | Length (km) | |
|---|---|---|---|
| Guwahati-Siliguri | 0 82 | 435 | 1 017 |
| Haldia-Barauni | 1 42 | 525 | 1 425 |
| Haldia-Maurigram-Rajbandh | 1 25 | 269 | 1 873 |
| Barauni-Mughalsarai-Allahbad-Panki(Kanpur) | 1.8 | 669 | 1 748 |
| Koyali-Sabarmati(Ahmedabad) | 1 1 | 116 | 1.565 |
| Mumbai-Pune | 3 85 | 161 | 3 85 |
| Mathura-Bijwasan(Delhi)-Ambala-Jalandhar | 3 7 | 513 | 3.283 |
| Kandla-Sidhpur-Salawas (Jodhpur)-Sanganer(Jaipur)-Rewari-Sangrur-Bhatinda | 6 | 1331 | 5 76 |
| Digboi-Tinsukia | 0 406 | - | 0 406 |
| Mumbai-Manmad | 4 | - | |

*Estimate

*Source* MoPNG (1999a)

With a view to augment the transport infrastructure, Petronet has finalized projects for 18 new pipelines across the country Amongst the new links 9 are being developed by IOC, 3 by HPCL, 5 by BPCL and one by NRL The NRL pipeline would link the Numaligarh refinery to Barauni The 3 HPCL pipelines include Deogarh-Miraj linked to the Deogarh refinery, the 400 km Bhatinda- Jalandhar-Jammu pipeline with a capacity of 1 mtpa, linked to the Bhatinda refinery and the Vasco-Belgaum-Miraj link

The 5 from BPCL include the 350 km Bina-Jhansi-Kanpur pipeline with a capacity of 2 4 mtpa, and Bina-Jabalpur-Bilaspur, which would link with the proposed refinery at Bina, the Sultanpur-Allahbad and the Sultan-Gorakhpur pipelines which would link with the proposed refinery at Sultanpur, and finally the Karur-Shankari pipeline which would provide an extension to the Cochin-Karur pipeline

IOC's pipelines would include the 500km Chennai-Tiruchy-Madurai pipeline with a capacity of 1 4mtpa and its extension Madurai-Tirunelveli, the Ennore-Kurnool-Raichur pipeline, the Koyali-Ratlam-Kota pipeline, the Koyali-Sidhpur pipeline, and the 550 km Paradip-Rourkela-Ranchi- Allahbad pipeline with a capacity of 2 6 mtpa, which would bifurcate into two pipelines Ranchi-Bokaro and Ranchi-Jamshedpur

Petronet has also reworked the mega pipeline proposal of Reliance Petroleum Limited (RPL) and has clubbed it with two other projects- one submittted by Essar Oil and the other planned by Petronet linking Koyali to Ratlam The Central India Pipeline as it will now be called, will begin from Jamnagar and reach Koyali where a new products storage terminal of IOC's Gujarat refinery is being planned From Koyali the pipeline will extend to Ratlam where it will bifurcate into two networks

The other major product pipeline which is under implementation is the 380 km Vishakhaptnam-Vijayawada multi-product pipeline with a capacity of 4 mtpa in the southern region This pipeline is being extended to Secunderabad increasing the total length to 588 km

The cost of expanding existing pipelines and implementing new proposals is estimated at Rs 50 billion In order to generate this large capital investment, an arrangement is required whereby each marketing and refining company has equitable use of the product pipeline capacity This will include joint-venture companies and private sector companies operating refineries or participating in the marketing of petroleum products, particularly after the dismantling of the administered pricing mechanism (APM) For this purpose, the government has approved the formation of a holding company (with participation from the public and the private sectors) and subsidiary joint venture companies for the implementation of petroleum product pipeline projects.

Besides, having to generate this large capital investment, an arrangement has to be made by the oil industry to ensure an equitable use of the available pipeline infrastructure by the marketing and refining companies The government has recently approved the formulation of a joint-venture company called 'Petronet' for putting up new pipelines at an initial cost of Rs 10 billion, with the ultimate objective of forming a pipeline grid The holding company will consist of four public sector marketing companies, namely, IOC, BPCL, HPCL and IBP of which they will hold equity to the extent of 50% This move is aimed at attracting private sector investment in pipeline projects, and appears to be a preparatory measure for the complete decontrol of the oil industry

To ensure the success of the venture, the Working Group on the Petroleum Sector for the IXth Plan period has recommended that the following policy be re-examined (Planning Commission 1997a):

1. The tariff to be charged by the pipeline company should be regulated to ensure adequate return on investments. It has been suggested that the tariffs are linked to the rail freight in order to provide for competition between the two modes.
2. Duty exemption for all materials required for the pipelines may be considered

Some of the pipelines for which the Feasibility Report has been formulated by Petronet are as follows

- Kochi-Coimbatore-Erode-Karur
- Vadinar-Sikka-Kandla
- Mangalore-Hassan-Bangalore
- Bina-Jhansi-Kanpur
- Chennai-Trichy-Madurai

#### *7.2.6.2 Port infrastructure*

Oil is handled at 13 port facilities in the country Crude is handled at the ports of Kandla, Mumbai, Kochi, Chennai,Vizag, and Haldia, while petroleum products are handled at the ports of Mangalore, Kandla, Okha, Goa, Tuticorn, Paradeep, and Port Blair In addition some amount of products are handled at the ports of Mumbai, Kochi, Chennai, Vizag and Haldia In the future, there is a likelihood of concentration of traffic in the Gulf of Kachch due to large volumes of crude import for the Bina, Panipat, Reliance, Essar, and Allahabad refineries

The past decade saw very little improvement in the port facilities The government therefore needs to consider allowing oil companies to undertake projects for augmentation of the port facilities, even though these facilities are currently owned by the port authorities (TERI 1999a)

## 7.3 Natural gas

The advancements in gas utilization technologies as well as environmental concerns are responsible for the growth in gas demand The capacity addition programme in the power sector, its deregulation, more stringent environmental stipulations, and advancements in gas turbine technologies have resulted in gas emerging as a preferred fuel for power generation.

The aggregate natural gas production in 1997/98 was 26 bcm and is likely to peak in the next two to three years A wide gap is expected to prevail between the domestic supply of gas and its potential demand unless major gas discoveries materialize following future exploration by PSUs and private companies In the Indian context, gas/ LNG (liquefied natural gas) imports can ease the shortage of primary energy supply provided it can be sourced at competitive prices with respect to domestic and imported alternative fuels

As detailed in the chapter on integrating energy markets in South Asia, India is considering pipeline gas as well as LNG imports from the Middle East and Central Asia, to meet the gas demand of markets predominantly in the northern, western, and southern regions LNG imports are an attractive option as they allow the market to build up in a phased manner and hence provide better flexibility from the marketing and operational aspects. High priority has been assigned to LNG imports at Ennore (Tamil Nadu) and Dahej (Gujarat) to meet the gas requirements of the southern and western regions, respectively LNG imports are also planned at Hazira and Kochi

In India, gas/LNG imports are being linked with power projects and would replace domestic coal Thus the economics of gas imports would depend upon factors such as the transportation costs and the ability of the power sector to pay for gas as a substitute for coal or another alternative fuel (Planning Commission 1997)

In the longer term, various supply options such as coal-bed methane, exploitation of gas hydrates, and in-situ coal gasification are being considered. The government has issued policy guidelines for the recovery of coal-bed methane offering fiscal and financial incentives to Indian and foreign investors

### 7.3.1 Pricing policy

For the future demand-supply perspective, it would be important to take the domestic gas price closer to the market-determined pricing regime. The deregulation of natural gas pricing needs to be undertaken concurrently with the dismantling of the APM for crude oil and petroleum products so as to establish a rational market-related pricing framework for the end-users.

With effect from 1 October 1997 up to 3 March 2000, the consumer price of gas at landfall points would be linked to the price of a basket of LSHS/FOs It is likely that the prices would be raised to a level of 100% parity with FO by the year 2001/02. The price of gas produced from medium-sized fields developed through joint ventures is already at the level of 100% fuel parity Figures 7.1and 7 2 illustrate the consumer price for gas in the north-eastern states and other states.

**Table 7.8 Natural gas prices**

| Year | As percentage of LSHS/FO prices<br>General price | <br>Concessional price for the north-eastern region |
|---|---|---|
| 1997/98 | 55% | 30% |
| 1998/99 | 65% | 40% |
| 1999/2000 | 75% | 45% |

*Source*· MoPNG 18 September 1997

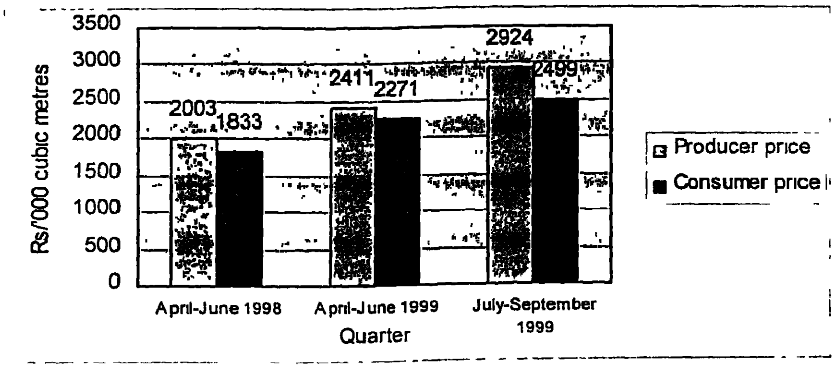
The main features of the new gas pricing policy issued by the MoPNG are as outlined below

- The price would be determined and notified for every quarter depending on the average prices of the basket of FOs based on the figures obtained from Platts Oilgram for the previous quarter The general and concessional price will be fixed as given in Table 7 8
- The consumer price of gas as above would be linked to a calorific value of 10 000 kcal/m$^3$
- The consumer price of gas will be reviewed at the end of the first three years (1997–2000) with a view to achieve 100% FO parity prices over the fourth and fifth years
- Over the period October 1, 1997 to March 31, 2000, the transportation charge payable to Gas Authority of India Limited (GAIL) along HBJ pipeline would be Rs 1150/mcm This will

increase by 1% for every 10% increase in the consumer price index. This increase will be paid to GAIL from the Gas Pool Account

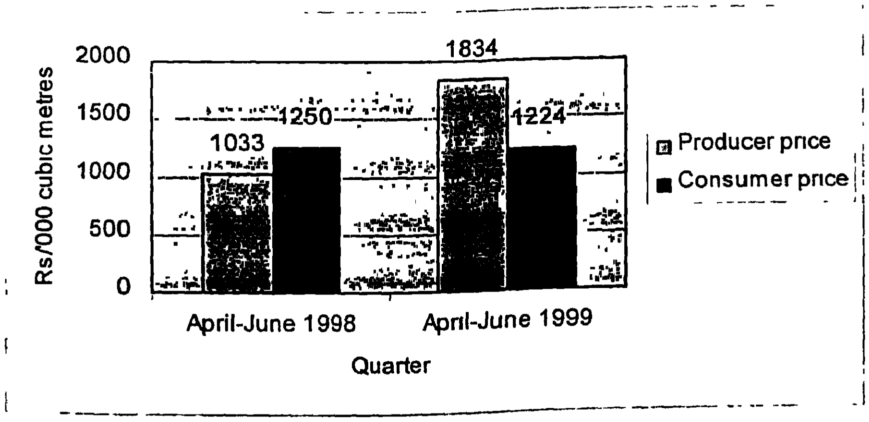
- In addition to the price as described above, the transportation charges, royalty, taxes, duties, and other statutory levies on production, transportation, and sale of natural gas will be payable by the consumers
- Of the consumer prices collected by GAIL, the amount required to pay for the higher cost of gas purchased from the JV Companies will be retained.
- The customs duty for LNG has been reduced from 12% to 5% with effect from April 1999

**Figure 7.1 Natural gas prices in the north-eastern states**



*Source MoPNG(undated)*

**Figure 7.2 Natural gas prices in other states**



*Source* MoPNG (undated)

### 7.3.2 Regulatory reform

Since 1987, the government has been fixing the price of gas, and it has also been deciding the allocation of gas to competing consumers. However, having decided to deregulate the sector, the government will need to bring in suitable legislation to appoint an independent regulator for the gas sector.

The regulator's role in the gas sector would be similar to that in the downstream oil sector as elaborated in the preceding section However, the transportation of gas through pipelines involves significant economies of scale and very little inter-modal competition, thereby calling for a set of regulations not required for petroleum products The aspects that need to be considered for regulation are (1) common carriage versus contract carriage, (2) authorization for gas transportation and distribution, (3) unbundling of trading and transmission, (4) cross-ownership between distribution and transmission, (5) fixing of transportation and distribution charges, regulation of the LNG sector, (6) open access for spare pipeline capacity, (7) pricing and allocation of natural gas and (8) distribution networks

### 7.3.3 Augmentation of transport infrastructure

The present gas infrastructure exists for production and transportation of about 90 mcmd of gas and transmission and distribution of about 65-70 mcmd The western offshore region is the major source of gas production, accounting for more than 70% of the total gas production Adequate offshore facilities exist for the compression and evacuation of gas to shore-based facilities at Uran in Maharashtra and Hazira in Gujarat The shore-based facilities in Uran can receive gas from two offshore trunk gas pipelines namely, Bombay High to Uran and Heera Field to Uran Similarly, the shore-based facilities at Hazira receive gas from two offshore gas trunk pipelines from the South Bassein field

The Bombay High-Uran pipeline has a diameter of 26 inches and a capacity of about 13 mcmd The two gas pipelines from South Bassein to Hazira are 36 inches and 42 inches in diameter with capacities of 22 mcmd and 30 mcmd, respectively The terminal at Uran can handle 16 mcmd of gas whereas the terminal at Hazira is being expanded to handle 41MCMD of gas, while the expected gas supply from the Western offshore region in the year 2000 is estimated at about 68 MCMD The Hazira terminal has the gas sweetening facilities for treatment of sour gas from South Bassein and other offshore fields

As regards the gas transmission and distribution network is concerned, a system of about 3800 km long pipeline trunk as well as spur (consumer) lines is presently in position. The largest pipeline system is the HBJ trunk pipeline system, which is more than 2000 km in length. The capacity of the HBJ system has been expanded from 18 3 MCMD to 33.4 MCMD, in July 1998 at a cost of Rs 23 760 billion. As part of the expansion plan, a trunk section (36 inches in diameter) has been added between Bijapur and Dadri

In addition, there are regional gas grids of varying sizes in the states of Gujarat (Cambay Basin), Andhra Pradesh (KG Basin), Assam (Assam-Arakan Basin), Maharashtra (Ex-Uran terminal), Rajasthan (Jaisalmer Basin), Tamil Nadu (Cauvery Basin), and Tripura (Arakan Basin)

The present grid spread is based on the gas availability from the regions as well as the projections for future gas production However, no major pipelines have been planned for the next two to three years even though gas production from domestic reserves is expected to peak by the year 2002 Major pipeline activity would be triggered when the pipeline gas import projects materialize Utilization of imported gas would require major trunk gas pipeline systems for transportation of gas to various regional markets The imports of LNG would also lead to the requirement of new pipelines GAIL is already laying a pipeline from Kandla to the northern region of the country

## 7.4 Power

### 7.4.1 Policy for private sector investments

Some of the measures taken by the government to facilitate private sector investment in the power generation sector are listed below

- The government has recently reviewed the policy on automatic approval of foreign equity for generation and T&D and has revised the limit from 74% to 100% of equity participation provided the project cost does not exceed Rs15000 million The projects that would qualify for such automatic approval are hydroelectric power plants, coal-lignite based thermal power plants and oil and gas-based thermal power plants

- For speedy environmental clearance the Ministry of Environment and Forests has agreed to delegate powers regarding environmental clearances to the states for cogeneration projects and captive plants up to 250 MW, coal-based plants up to 500 MW using fluidized technology, power stations up to 250 MW on conventional technology, gas/naphtha-based stations up to 500 MW
- Fuel linkages have been provided for capacity addition based on liquid fuels
- The limit in respect of different categories of power schemes beyond which the concurrence of the CEA would be required has been enhanced in November 1998
- In view of the large amount of funds required and the limited budgetary support, the ceiling of 15% on lending by the IFIs to any one sector has been removed
- The policy announced in 1991 envisaged that not more than 40% of the total outlay for the private sector units may be raised from Indian Public Financial Institutions (IPFIs) The government has recently removed the ceiling for the extent of domestic debt, subject to the need for maximizing financing from external sources and the adoption of a norm by the IPFI whereby, a higher domestic debt component would be allowed for projects based on indigenous equipment
- The SEBs have been restructured in several states
- Regulatory bodies have been established

**Table 7.9 Status of PPP (Private Power Projects) as on July 1999**

| Description | Number | Capacity (MW) |
|---|---|---|
| Projects with techno-economic clearance from the CEA (Central Electricity Authority) | 48 | 23066 |
| Projects with in-principle clearance from the CEA | 25 | 14309 |
| PPPs commissioned in past five years | 21 | 5000 |
| PPPs under construction | 21 | 5684 |
| PPPs with finances tied up with IFIs (Indian Financial Institutions) | 57 | 17062 |
| PPPseeking tie-up with IFIs | 50 | 16183 |
| PPPs awarded through MoU/LoI | 72 | 38910 |
| PPPs awarded through the competitive bidding route | 26 | 16621 |

*Source* Ministry of Power (1999)

The extent of private sector investment in the power sector is largely dependent upon improving the financial conditions of the SEBs through reforms and restructuring. In addition, the ability of independent power producers to enter into reliable fuel supply agreements and transport arrangements will determine the progress of private investments So far private projects with a total installed capacity of 5000 MW have been commissioned as illustrated in Table 7.9. While the planned capacity addition in the private sector during the Ninth Plan period is 17 588 MW, it is estimated that only 2000 MW of the capacity addition would actually take place

The shortfall in the private sector investments, can be attributed to the following factors

- Unwillingness of lenders to finance large independent projects,
- High financial risk involved in selling power to a monopoly buyer such as the SEBs;
- Delays in obtaining various statutory clearances

Some analysts believe that the strategy adopted by the government for private sector participation should have encouraged capacity addition by the existing private sector generators such as BSES and CESC through collaborative ventures bringing in foreign investments and technologies. Moreover, the large engineering firms familiar with the setting up of captive power plants could have been encouraged to set-up independent power projects rather than pursuing US, European and Japanese power industries which were reluctant to set-up generation capacity in India, in view of the poor financial health of the SEBs, the sole buyers of electricity.

Some of the policy objectives to add power generation capacity in the future have been discussed below (MoP, 1999):

### *7.4.1.1 Mega power projects*

The guidelines for setting up mega power projects were initially issued in November 1995 Accordingly power projects of capacity 1500 MW or more and supplying power to more than one state were defined as mega power projects The government, however, has revised the mega power policy setting the benchmark of 1000 MW in case of thermal projects and 500 MW in case of hydro-electric projects for availing the duty-free incentives Some of the provisions of the revised policy are as follows

- Inter-state and inter-regional mega power projects are proposed to be set up both in the public and private sectors
- The Standing Independent Group (SIG) which had been constituted by the government in November 1997 to establish the parameters for negotiation of large power projects, would initially be the apex body to oversee the implementation of the mega private power projects
- The principles of competitive bidding would be adhered to as far as possible, while obtaining tariff offers
- To ensure that domestic bidders are not affected adversely, a price preference of 15% would be given to the projects under the public sector, and deemed export benefits under the Export–Import policy would be given to domestic bidders under both public and private sectors
- A Power Trading Corporation (PTC) is to be formulated under the new policy An LoC and recourse to the state's share of central plan allocations would make the PTC secure.
- The necessary precondition for the PTC would be that the state should constitute a regulatory commission with full powers to fix tariffs as envisaged in the Electricity Regulatory Commissions Act, 1998 and privatize distribution in cities with a population exceeding one million
- The import of capital equipment for these projects would be free of customs duty

- The income-tax holiday regime would continue for a block of 10 years within the first 15 years
- The state governments are requested to exempt supplies to mega power plants from sales tax and local levies.

It is expected that 15 000-20 000 MW of capacity addition would be achieved through this policy by the end of the Tenth Plan period, with the most competitive tariffs payable by the state electricity boards (SEBs) and consequently by the consumers

#### *7.4.1.2 Liquid fuel-based power projects*

In view of the long gestation period for coal/lignite, gas, and hydro-electric projects, it was recognized that for a quick capacity addition, it would be an economically viable option to set up liquid fuel-based power projects A few combustion turbine-based combined cycle plants using liquid/gas fuels are being considered in areas where the transportation of coal is either costly or infeasible The use of naphtha-based power plants would be confined to only those power producers who have been allocated liquid-fuel linkages under the provisions of the liquid-fuel policy as this option for power generation is both uneconomical and short-sighted

Modifications to the liquid-fuel policy have been made recently on the basis of requests for providing additional linkages for new projects and for putting up power projects based on non-traditional fuels such as condensates and orimulsion. The following decisions were taken in July 1998

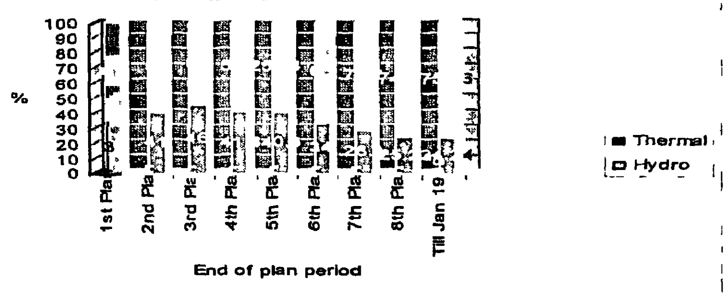
- The existing ceiling of 12 000 MW allocated to various states would apply only to naphtha This would be in addition to the fuel oil/low sulphur heavy stock (FO/LSHS) linkages already given,
- States would, therefore, be free to contract for new projects based on FO beyond the existing linkage,

- Taking into account the environmental stipulations, it would be mandatory for FO- based power plants to use the Integrated Gassification Combined Cycle Technology (IGCC), or any other technology that would ensure sulphur emissions within the stipulated levels,
- LSHS is already on Open Generalized License and this facility would be extended to other non-traditional fuels such as orimulsion depending upon actual user conditions,
- There would be no obligations for oil public sector undertakings to give fresh linkages for any new projects, except naphtha-based projects within a ceiling 12 000 MW and projects based on other fuels for which linkages have already been issued; and
- High speed diesel (HSD) would be permitted for power generation only in inaccessible and isolated areas, where small diesel-based capacities are sought to be setup and other fuels are not feasible.

### *7.4.1.3 Hydroelectric projects*

The Ninth Plan envisages an addition of 9820 MW of hydro capacity. The Plan-wise installed generation mix is provided in Figure 7.3. The capacity addition is expected to be achieved through the prioritization of hydroelectric power development and conducive institutional and financial arrangements. Inadequate hydel support in the western and eastern regions is affecting the performance of the thermal plants adversely, as they provide the peaking power, thus having to back down during non-peaking hours.

**Figure 7.3 Planwise installed hydro-thermal capacity mix (%)**



*Source:* MoP (1999)

The National Hydroelectric Power Corporation (NHPC) is one of the important players in the development of hydroelectric power in the Central sector In addition to the ongoing hydro projects, the NHPC is also examining new turn-key projects and small and mini-hydro projects which are expected to rectify the prevailing imbalance in the hydro-thermal mix. The North-Eastern Electric Power Corporation has also taken up several projects in the north-eastern region, which has an enormous potential for hydro power estimated at 48 000 MW (MoP,1999) The National Thermal Power Corporation (NTPC) has also initiated action for the development of hydro projects in the upper reaches of Uttar Pradesh.

Development of water resources of the rivers flowing through India, Nepal, and Bhutan has been under discussion India has been providing technical and financial assistance to Nepal in the development of hydropower potential in exchange for surplus power. Three major water resource projects in Nepal, namely, Karnali (1080 MW), Pancheswar, and Saptakoshi (3300 MW), are presently under discussion for mutual benefits In Bhutan, the 336-MW capacity Chukha hydroelectric project is operating in an excellent manner and is an example of cooperation between India and Bhutan Surplus power is being purchased by India in exchange for the technical and financial assistance provided for the development of the project The Tala hydro-electric project with a capacity of 1020 MW has been taken up for implementation and has been funded by India in exchange for surplus power In addition, investigations for Sankosh (4060 MW), Wangchu (900 MW), and Bunakha (180 MW) projects have also been completed.

### 7.4.1.4 *Nuclear power projects*

The current nuclear capacity of 2225 MW constitutes only 2 6% of the total installed capacity The nuclear power generation capacity has grown at a very slow rate due to paucity of funds. The Nuclear Power Corporation of India has limited internal resources and faces several constraints in mobilizing funds from external sources and the private sector. Greater budgetary allocation, therefore, is required in this sector In view of private sector participation in thermal and hydro projects, there is a need to explore the possibility of private investments in nuclear generation as well It is necessary to ensure that the high degree of self-reliance in nuclear power generation is further consolidated, upgraded, and utilized for higher capacity addition.

In the transmission sector, private sector investment is proposed to be limited to the construction and maintenance of transmission lines on the BOOT (build own operate transfer) basis, for operation under the supervision and control of the Powergrid Corporation of India Limited, which has been notified as the central transmission undertaking (CTU) and the transmission companies at the state level or the state transmission undertakings (STUs) The process involves identification of the transmission lines by the CTU/STU to be entrusted to the private operators, issue of specifications, and selection of the private party On selection of the private party, the CTU/STU would recommend to the Central Electricity Regulatory Commission/State Electricity Regulatory Commission) the issuance of a transmission license The transmission charges payable to the company would be directly linked to the availability of the lines The detailed guidelines for private sector participation have been prepared by the government

### 7.4.2 Pricing policy

In India, different categories of consumers are charged differential tariffs The five major categories are domestic, agriculture, commercial, industrial, and railway traction The tariff for the first two categories is less than the average cost of supply while that for the last three categories is more than the average cost of supply Hence the first set of consumers is cross-subsidized by the second set

The average tariff for sale of electricity by SEBs increased from 105 4 paise/kWh in 1992/93 to 197 9 paise/kWh in 1998/99 However, there exist large inter-state and categorywise variations in the average tariff (Planning Commission 1999a)

The recovery of costs through tariffs is necessary for the financial health of SEBs The percentage of sales revenue realized to the cost incurred decreased marginally to 78 8% in 1997/98. The sales revenue to cost ratio is particularly low in the states of Jammu and Kashmir, Assam, and Bihar and below average in a number of other states.

Considering the requirement for better utilization of the existing capacity through most economic generation and to meet the peak load demand through commercial signals, the government recently decided to implement plant availability and frequency-linked tariff in generation for the central sector utilities The move is expected to achieve the following objectives

- Rational recovery of fixed costs from beneficiaries
- Provide a fiscal mechanism to encourage high availability of plants to meet peak demand
- Most economic generation will be encouraged
- Rationalization of the contractual demand between SEBs and central sector generators
- Fiscal disincentives for overdrawl during low-frequency conditions and underdrawl during high-frequency conditions

### 7.4.3 Regulatory reform

The future development of the power sector primarily depends on two factors· (1) financial viability of SEBs and (2) the operating efficiency The losses suffered by the SEBs are estimated at $ 3 25 billion in 1998/99, which implies a 17% increase over the previous year The SEBs therefore, need to be restructured in order to restore efficiency of operation within a definite time-frame In addition, the changing scenario in the power sector requires further delegation of powers and simplification of procedures (MoP 1997)

The objectives of the power sector reforms are as follows

- To promote the development of the power sector by ensuring generation and supply at an economic cost
- To provide reliable and high quality service to the consumer
- To ensure the financial viability of the SEBs, thereby attracting private sector investments

The Electricity Regulatory Commission Act, 1998 provides the legal basis for setting up a commission at the central level with separate commissions at the state level. The CERC was formulated under the provisions of this Act on 24 July 1998. The functions of the CERC are listed below

1. Regulate the tariff of generating companies owned or controlled by the central government
2. Regulate the tariff of generating companies other than those controlled by the central government, if such generating companies enter into, or otherwise have a composite scheme for generation and sale of electricity in more than one state.
3 Regulate the inter-state transmission of energy including tariff of transmission lines
4 Promote competition, efficiency, and economy in the activities of the electricity industry
5 Aid and advise the government in the formulation of a tariff policy which shall be fair to the consumers and facilitate mobilization of resources
6 Associate with the environmental regulatory agencies to develop appropriate policies and procedures for environmental regulation.
7 Frame guidelines in matters related to electricity tariff
8 Arbitrate or adjudicate upon disputes involving generating companies or transmission utilities indicated in (1) and (3)
9 Aid and advise the central government on any other matter referred to commission by the government.

Section 17(1) of the Electricity Regulatory Commission Act empowers the state government to establish an SERC. The functions of the SERC are listed below

1 Determine the tariff for electricity, wholesale, bulk, grid or retail
2 Determine the tariff payable for use of the transmission facilities
3 Regulate power purchase and procurement process of transmission utilities and distribution utilities
4. Promote competition efficiency and economy in the activities of the electricity industry.

The Electricity Supply Amendment Act, 1998, provides for the constitution of a regional electricity board constituted by the central government for a specified region for facilitating the integrated operation of the power system in that region.

In the states of Orissa, Haryana, Andhra Pradesh, and Rajasthan reasonable progress has been made in restructuring the SEBs In Andhra Pradesh, the SEB personnel expressed concern about the restructuring and the Chief Minister was successful in building-up a strong support and the reform process has progressed well Restructuring has been initiated in other states including, Uttar Pradesh, Madhya Pradesh, Gujarat, and Tamil Nadu In the case of Uttar Pradesh there was a confrontation between the SEB staff and the management, which was resolved in a judicious manner by the government

The government has recently proposed the draft Electricity Bill 2000 making it mandatory for all states to dismantle the SEBs within six months of the Bill being passed The Bill will replace all the existing electricity laws. Some of the important features of the Bill include.

- States to be given six months to dismantle the SEBs into three corporations
- Licensees like BSES and CESc to get one year to continue under the old rules
- Central and state regulatory authorities to be the prime authorities, truncating the powers of the CEA
- A cess of 2 paise/unit to be levied on all generation

### 7.4.4 Augmentation of transmission and distribution infrastructure

The development of power generation facilities is required to be matched by the concomitant development of a transmission system for transmitting the generated power to the load centres It has been established that the transportation of coal is less economical than the transmission of an equivalent amount of electric power over long distances This has led to the development of pithead-based power generating units with an extensive network of transmission lines for transmitting power to the states

The 15th Electric Power Survey has estimated a deficit of 8000 MW for the northern region by the end of the XIth Five Year Plan With a large amount of generation capacity addition planned in the eastern and southern regions, a surplus of 7000 MW and 2500 MW in the eastern and southern regions, respectively is estimated, which would be required to be evacuated to meet the shortfall in the northern and western regions.

The regional concept in the power system is giving way to a more integrated approach in the form of a national power grid, which will facilitate transfer of power from regions of surplus to regions of deficit. The 400 kV AC system would be the mainstay of the extra-high voltage (EHV) transmission system in the next 15 years to be supplemented by 765 kV DC system and high voltage DC system in certain corridors for bulk power transfer.

While SEBs are responsible for developing the transmission and distribution (T&D) system at the state level, the Powergrid Corporation of India Limited is responsible for developing the central sector transmission system, including setting up the national power grid

Although the regional grids have been inter-connected paving way for the formation of the National Power Grid, further strengthening of the inter-regional and intra-regional grid would be essential to facilitate power exchanges During 1998/99, all the five regional grids namely, northern, western, southern, eastern and north-eastern, were operating in parallel

The growth in the T&D network has resulted in an increase in the number of towns and villages electrified All urban areas and over 0 5 million villages of a total of 0 7 million villages have access to electricity so far The total number of pumpsets energized as on 30 November 1998 was about 11 9 million, which led to a growth in agricultural production However, about eight million pumpsets still remain to be energized.

## 7.5 Renewable energy

One of the most important strategies that needs to be adopted for the conservation of the natural resource base, thereby ensuring its efficient use, and preservation of the environment, is the development and promotion of appropriate technologies using renewable resources such as biomass, water, wind, and solar energy Renewable energy technologies (RETs) have a vast potential and have the advantage of being environmentally sustainable

Even though the initial capital and production costs are higher than that for conventional energy, RETs could prove to be more competitive in the long run, keeping in view the low costs and abundance of the renewable energy sources and the financial incentives provided to both the consumers and producers. Moreover the cost of power generated from renewable energy sources compares quite favourably with the cost of generation from conventional fuels (Table 7.10) The Confederation of Indian Industry has therefore recommended, that the government establish a comprehensive pricing policy, incorporating an incentive package for the non-conventional energy sources.

**Table 7.10 Cost comparison of power generation using renewable energy sources vis-à-vis conventional energy**

| Source | Cost (Rs crore/MW) |
|---|---:|
| Conventional sources | 4 |
| Wind | 3 5 |
| Small hydro | 3.5-6 0 |
| Biomass cogeneration | 2-2 5 |

*Source.* Bath, D S 1998

In India, the renewable energy programme can be traced to the first oil shock in the early 1970s which led to the creation of the Commission for Additional Sources of Energy (CASE) Subsequently, the Department for Non-conventional Energy Sources was formed which was upgraded to the Ministry of Non-conventional Energy Sources (MNES) in 1992. The Indian Renewable Energy Development Agency Limited (IREDA) was established in March 1987 as a public sector enterprise for the promotion, development, and financing of new and renewable sources of energy (NRSE) technologies The total disbursement made by IREDA for various RETs as on 31 December 1997 was Rs 625 53 crore. At the same time, financial assistance from the World Bank, the United Nations Development Programme, and the Global Environmental Facility have helped in supporting the development of RETs.

In India, renewable energy technologies have been developed for power generation, heating, cooling, lighting, pumping, cooking devices, and as alternative fuels for surface transport About 1050 MW of power generating capacity, constituting approximately 7% of the total power capacity addition during the Eighth Plan, is contributed by non-conventional energy sources. Besides, millions of people in rural areas have benefited from biogas plants, smokeless chulhas, and solar lanterns The MNES has adopted a three-pronged approach for the implementation strategy. This comprises (1) providing budgetary support for R&D and demonstration projects, (2) extending institutional finance through IREDA for private sector participation and bilateral and multilateral projects, and (3) promoting private investment through fiscal incentives, tax holidays, etc.

However, despite the policy initiatives and the large potential renewable energy has not made a significant contribution to the total energy mix in the country, except perhaps in the direct use as a biofuel in the rural domestic sector This can be attributed primarily, to the large costs involved in setting-up of renewable energy technologies, thereby making them uneconomical, and the marginal budgetary support that has been provided for the development of these technologies (During the Eighth Plan period only 0 8% of the energy funds were allocated for the development of renewable energy). It has been recommended that involvement of industry, in both research and development and as a source for private capital, could catalyse the development of RETs.

### 7.5.1 Policy for private sector investments

In order to realize the full potential of RETs, the government has announced a comprehensive renewable energy policy with the objective of promotion, development and commercialization of RETs In doing so it seeks to reduce the technical and non-technical barriers that hinder the development of projects such as land acquisition, legal constraints, pricing etc The policy aims to raise adequate funds for the development of RETs through a strategy to encourage private investors, the development of viable technologies and a ready market for their adoption In addition the policy emphasizes the need to stimulate the market growth through competitive pricing, and adequate retail outlets, which would provide the necessary impetus for the development of manufacturing and servicing industry The Indian Renewable Energy Development Agency also provides the users and manufacturers of RETs with attractive financial packages and special loans at low interest rates (MNES, 1999)

In response to the policy guidelines the MNES has drawn-up an action plan to generate more than 2000 MW of grid power from renewable energy sources in the Ninth Plan period and has provided the following financial incentives to encourage private sector investments

- 100% depreciation,
- Availability of soft loans,

- Reduced customs duty on imported equipment and materials,
- Remunerative prices for the power fed into the grid,
- Attractive facilities for the wheeling and banking of power,
- Purchasing Power Agreements with the SEBs
- Absence of a pollution penalty, and
- A five year tax holiday

With the objective of promoting the interests of the private investors, who account for about 93% of the total investments in the non-conventional energy sector, the MNES in 1996 proposed a substantially higher tariff of Rs 2.25 /kWh (to be increased annually by 5%) for solar, small hydel and wind power projects Though most states have not viewed the proposal with much enthusiasm, Tamil Nadu purchases power at a higher rate of 2 75 /kWh from the privately run wind farms which constitute a large share in the generation mix

The implementation of the policy encouraging development and investments in renewable energy technologies has resulted in the development of 1200 MW of generating capacity from renewable energy sources, installation of nearly 2 5 million biogas plants, 25 million improved chulhas, 380,000 square km of solar thermal collector area, 442,000 solar cookers and 5 2 MW of photovoltaic systems

## References

1. Bath D.S 1998.*Indian Power Projects Regulation Policy and Finance.* Hong Kong Asia Law and Practice Publishers
2. Desai R N 1999 *New Exploration Licensing Policy.* [Paper presented at Programme on Energy, Environment, Resources, and Sustainability (PEERS) 1999/2000 held in New Delhi]
3. MoC.1999 *Annual Report 1998/99* New Delhi Ministry of Coal Government of India
4. MoP 1999. *Annual Report 1998/99* New Delhi Ministry of Power New Delhi. Government of India.
5. MoPNG. 18 September 1997 *Letter on natural gas pricing* New Delhi Ministry of Petroleum and Natural Gas, Government of India
6. MoPNG. 1999 *Annual Report 1998/99* New Delhi Ministry of Petroleum and Natural Gas Government of India.
7. MoPNG. 24 November 1997. *Gazette Notification* New Delhi Ministry of Petroleum and Natural Gas, Government of India
8. Petroleum Economist 1999 *Energy in South and Central Asia* various editions
9. Planning Commission 1999a *Annual Report on the Working of the State Electricity Boards and Electricity Departments* New Delhi· Planning Commission, Government of India
10. Planning Commission 1996 *Report of the Committee on Integrated Coal Policy* New Delhi Planning Commission Government of India
11. Planning Commission 1997 *Report of the Sub-Group on Natural Gas for the Ninth Five Year Plan* New Delhi Planning Commission. Government
12. Planning Commission 1997. *Report of the Working Group on the Petroleum Sector for the Ninth Five Year Plan* New Delhi Planning Commission Government of India
13. Planning Commission 1999 Ninth Plan Document New Delhi Planning Commission, Government or India
14. Sengupta S 1999 *A regulatory body for the liberalised coal industry* Economic and Political Weekly New Delhi.

15 Srivastava L, Narang R K, Sen A 1999. *Issues in the Deregulation of the Oil and Gas Sector* New Delhi. Tata Energy Research Institute

16 TERI 1998 *India's Environmental Pollution and Protection* New Delhi Tata Energy Research Institute

17 TERI 1999 *TEDDY (TERI Energy Data, Directory and Yearbook 1999/2000)* New Delhi. Tata Energy Research Institute

18 TERI 1999a *India's Energy Security* New Delhi Tata Energy Research Institute

19 The Electricity Regulatory Commissions Act, 1998 New Delhi 2 July 1998

20 TPL Undated *Technical Memento* Pune. Thermax Private Limited

# Chapter 8: Energy policy in Pakistan

## 8.1 Oil and gas

The Petroleum Policy of 1994 was to a large extent successful in the development of the upstream sector The policy, however, could not arouse sufficient interest to attract investment in the downstream sector, off shore areas and the Baluchistan Basin The Petroleum Policy of 1997 is based on a review of the policy of 1994 and emphasizes the need to build a strong indigenous exploration and production base thereby achieving greater self-reliance and cost effectiveness The policy also focuses on mobilization of greater resources and promotion of private sector investment in the oil and gas sector

As a part of the privatization policy, the government has initiated the process of setting-up the Natural Gas Regulatory Authority and the Petroleum Regulatory Board The authorities will foster competition, improve efficiency and availability through augmentation of the transportation and distribution network and through improved regulation The determination of well-head prices would also be included as a part of the functions of the regulatory bodies

In recognition of the importance of the oil and gas industry in the overall economic development of the country, the new government lead by Gen Musharraf has announced the following policy guidelines to promote investor confidence in the country

- Accelerate exploration and development of oil and gas fields and increase efforts to attract foreign investment through major concessions for onshore and offshore exploration
- Develop recently discovered gas reservoirs with an estimated recoverable reserve of 6 5 tcf
- Establish new regulatory authorities to oversee the development and operation of the oil and gas sectors A draft Natural Gas Regulatory Authority Bill was passed in July 1999, though the regulatory authority is yet to be set up.
- Encourage the use of gas in power generation
- Develop upstream infrastructure including pipelines, through increased investments from the private sector
- Deregulate the oil and gas sector, and to this end enhance private sector participation The new government has also decided to use the profits from privatization to service the external debt.
- Deregulate the price of LPG

### 8.1.1 Exploration and production

In view of the expected shortfall of 0.38 mb/d in oil supply by the year 2005 and the decline in the budgetary support to the oil and gas sectors, efforts are being made to encourage private sector participation in the exploration and production sectors that are concentrated in the Potwar Plateau in Punjab and the lower Sindh Province. A total of 16 gas discoveries of about 40.5 bcm have been made recently thereby adding 30%-35% to the country's reserves, however an estimated investment of $ 1 billion would be required to develop these fields According to estimates Pakistan is expected to save up to $ 100 million annually in foreign exchange by substituting gas for oil, and could earn about $ 100 million in taxes and $ 50 million in royalties However, one of the major constraints for the development of the reserves is that since many of the fields are located in remote areas that are not easily accessible to markets, they would need to be developed in a coordinated manner, thereby facilitating the use of a common infrastructure The price of gas has also been a contentious issue, and needs to balance the need for the investors to earn a minimum rate of return as well as the consumers' ability to pay Moreover, the slump in the world crude oil price has adversely affected the development of these fields.

The Director General of Petroleum Concessions has invited international oil companies to bid for oil and gas exploration in the Sindh and Baluchistan provinces and the offshore Indus basin Petronas and Lasmo Oil are amongst the companies that have been awarded licenses for exploration The government is also considering a proposal to amend the land acquisition laws to allow seismic surveys for oil exploration in the Punjab province According to a recent policy initiative the gas exploration companies have been given the option of selling the gas directly in the open market since the price paid by the Sui Northern Gas Pipeline and Sui Southern Gas Company, under the existing buy-back agreement is only $ 0 50/'000 cubic feet as compared with the agreement price of $ 2 65 –$ 2 80/'000 cubic feet

The Privatization Board has decided to privatize six oil wells and a number of the recent gas discoveries The sale of 26% stake in the Oil and Gas Development Corporation's assets especially in the Qadirpur gasfield and the Dhodak and Dullian oilfields is estimated to raise $ 400-$ 500 million In addition, the total divestment of the exploration and production company Pakistan Petroleum Limited (PPL), is being negotiated with the International Finance Corporation, which has invested about $ 50 million and holds a 6 09% equity in the company.

The government also envisages a divestment to the extent of 26% of its direct holding in the Sui Southern Gas Company (SSGC). The SSGC was formed in March 1989 following the merger of the Sui Gas Transmission Company and the Southern Gas Company Ltd. SSGC's role extends from purification of natural gas, to its transmission and distribution to industrial, commercial and domestic consumers in the provinces of Sindh and Balochistan. SSGC is also engaged in the bottling and sale of LPG, and manufacturing of gas meters. The divestment is expected to be implemented after the passage of the Gas Regulatory Authority (GRA) Bill

The divestment of the entire oil and gas industry in Pakistan is expected to generate $14 billion, while the sale of 20%-30% of the government's holdings could generate an investment of $ 50-$ 60 million by the end of the year 2000 The privatization of several of the upstream and downstream oil and gas companies including SNGPL, SSGCL and PPL is already underway Several incentives have been introduced for encouraging investments in the upstream and downstream sectors, including production-sharing arrangements in the offshore areas.

### 8.1.2 Refining

Pakistan's current refining capacity of 0.131 mb/d is expected to increase to about 0 46 mb/d by the year 2001, with the commissioning of the 0 1 mb/d Pak-Arab refinery in Punjab, the 0 13 mb/d Iran-Pak refinery in Baluchistan and the 0 1 mb/d Mid Country Refinery Project near Multan (Table 8 1). In addition two more refineries are being planned at Badin in the Sindh Province and at Korangi near Karachi with capacities of 0 03 mb/d and 0.1mb/d, respectively The latter is being planned by the Pakistan State Oil company in collaboration with the Hyundai Corp of South Korea

**Table 8.1 Operating refining capacity and planned additions (mb/d)**

| Refinery | 1999 | 2000 | 2001 | |
|---|---|---|---|---|
| Attock Refinery Limited | | 0.03 | 0 03 | 0 03 |
| Pakistan Refinery Limited | | 0.04 | 0.04 | 0 04 |
| National Refinery Limited | | 0 06 | 0.06 | 0 06 |
| Dhodak Refinery Limited | | 0 | 0 | 0 |
| Iran-Pak Refinery | | _ | _ | 0.13 |
| Pak-Arab Refinery | | _ | 0.1 | 0.1 |
| Mid Country Refinery Project | | _ | 0.1 | 0.1 |
| Total | 0.13 | 0 33 | 0.46 | |

*Source* EIA, 1999

### 8.1.3 Pricing policy

#### *8.1.3.1 Oil*

According to the petroleum pricing policy offshore crude oil is priced at import parity, while natural gas produced offshore is priced at par with the international fuel oil price

The price of petroleum products is regulated by the government, and is ascertained using a formula that allows a mark-up on the import/ex-refinery price to recover the cost of distribution and transportation. In addition excise duty and a regulatory development surcharge are levied on products such as motor spirit (MS), high speed diesel (HSD), furnace oil (FO) and high octane burning component (HOBC). The pricing policy aims at the highest taxation of products such as HOBC and MS consumed largely by the higher income groups, followed by HSDO which is used for public transportation Taxation is lowest for furnace oil which is used in the power generation sector, kerosene which is primarily used as a domestic cooking fuel in the low-income groups and light diesel oil (LDO) which is used for operating agricultural tubewells

However, the current pricing formula for petroleum products makes the domestically refined products more expensive than the imported products, thereby effecting the competitiveness of refineries Therefore in order to boost investment in the refining sector, the government has introduced a new pricing formula that links the price of petroleum products to the Singapore mean spot price

In order to boost LPG imports, it has been recommended that the existing import duty of 10% is reduced and the withholding tax of 5% is abolished This has been viewed as necessary for meeting the shortfall in LPG, estimated at about 15 mb Also the opening of an import terminal with a capacity of 0 07 mb at Port Qasim, near Karachi, would provide the required infrastructure for imports

#### *8.1.3.2 Natural gas*

Under the 1994 Petroleum Policy the price of non-associated gas is indexed to the C&F price of a basket of imported crude oil and varies depending upon the zone in which the discovery is located In July 1999, the government proposed a new gas pricing policy that linked the producer price of gas to the weighted average of a basket of international crude oil prices subject to a ceiling in the price of gas The proposal was unveiled in response to the government's concerns that the two state gas transmission and distribution companies SNGPL and SSGCL, the main buyers of gas in Pakistan would be unable to pay for large scale additional gas supplies under the terms of the 1994 and 1997 policies. While offering the protection of a floor price to protect the producers against low oil prices the proposed pricing structure will reduce field development project returns in case of high oil prices.

The government also plans to curtail subsidies on the price of gas paid by the domestic and fertilizer sectors. Domestic consumers currently pay $ 0.97/'000 cubic feet and the fertilizer companies pay as little as $ 0 68/'000 cubic feet, while other industrial consumers pay $ 1.98/'000 cubic feet The phased withdrawal of subsidies could lead to a near 100% increase in the price of gas, which is being targeted at $ 1 55/'000 cubic feet Recently the government has increased the gas tariffs for domestic consumers by 3 5% while that for other consumers rose by 7.75%, however the increase in prices has not been implemented for feedstock in the fertilizer plants

### 8.1.4 Augmentation of transport infrastructure

#### *8.1.4.1 Oil*

In view of the 0 1 b/d Pak-Arab refinery that is scheduled to be completed in September 2000, a new 900km crude pipeline is being planned from Port Qasim near Karachi to Mahmood Kot (900 km north of Karachi), the site of the refinery The contract for the construction of the pipeline has been awarded to the Pak-Arab Refinery Limited (Parco) Pakistan's first LPG import terminal with a capacity of 100,00 tonnes of storage capacity has been also been set up by the Engro Paktank Terminal Limited (EPTL) at Port Qasim

Pakistan State Oil (PSO) is the largest company engaged in storage, marketing and distribution of petroleum and related products It has recently implemented an 80 km pipeline with a 14" diameter from the Zulfiqarabad terminal to the Hub Power Plant to transport upto 18 32 mb of fuel oil It is also planning the construction of 15mb-33 mb fuel oil pipeline from Zulfiqarabad to Jamshoro.

#### *8.1.4.2 Natural gas*

The Sui Southern Gas Company (SSGC) is an integrated state-owned gas company formed in 1989, following the merger of the Sui Gas Transmission Company, and the Southern Gas Company Ltd. SSGC's functions extend from purification of natural gas, to its transmission and distribution to industrial, commercial and domestic consumers in the provinces of Sindh and Balochistan. SSGC has a total of 2486 km of gas transmission lines, and 17,238 main and service lines, with a capacity to supply 4928 mcm of gas. The gas distribution network extends over 1933 km supplying gas to about 112474 consumers. In view of the large gas discoveries estimated at about 40.5 bcm, augmentation of infrastructure will be necessary to facilitate the production and transportation of gas

OMV Pakistan along with its joint-venture partners has signed an agreement with the SSGC for the sale and distribution of gas from the recently discovered Miano and Sawan fields that are estimated to produce 3.63 mcm/d of gas A 350km pipeline from Miano to the processing plant in Kadanwari is therefore being planned The processed gas will then be injected into SSGC's transmission system, with the first flows scheduled for 2001. The BHP Petroleum- led consortium has also signed an agreement with the SSGC for the supply of 1 8-2 1 mcm of gas from the Zamzama gasfield, through a 12 km pipeline to SSGC's Indus Right Bank pipeline system for onward transmission to Karachi.

Sui Northern Gas Pipelines Ltd (SNGPL) is the largest gas transmission and distribution company in Pakistan, with a franchise area comprising of the provinces of Punjab and NWFP The distribution network comprises of a network high-pressure transmission lines extending over 4687 km SNGPL has also been involved in the laying of transmission pipelines, compression facilities, provision of gas to new towns, and upgradation of telecommunication facilities

## 8.2 Power

The responsibility for power supply is shared between the two vertically integrated public sector utilities namely Water and Power Development Authority (WPDA) and Karachi Electric Supply Corporation (KESC) Apart from their own power generation sources the two systems are also fed by private sector power plants WAPDA supplies power to the whole country except Karachi, which is supplied by power by the KESC The two systems of WAPDA and KESC are interconnected through a 220 kV double circuit transmission line.

WAPDA dominates the power sector by supplying 9929 MW, while KESC supplies the remaining 1735 MW of the total generation capacity of 14834 MW Private power plants and the nuclear powered Karachi Nuclear Power Plant (KANUPP) account for the generation of 3033 MW and 137 MW, respectively, which is distributed through the WAPDA and KESC systems Pakistan's second nuclear power plant at Chashma has also added 325 MW of installed capacity Excluding KESC, the country's distribution network is divided into eight Area Electricity Boards (AEBs) which are currently a part of the WAPDA. The government intends transforming the current AEBs into privately owned but regulated distribution companies

While the GDP growth rate has averaged 5 7%, over the last two decades, the demand for electricity has grown at a much higher rate of 9% per year. According to the forecasts made by the World Bank and WAPDA the growth rate in electricity demand is expected to exceed 8% in the years to come Peak demand for electric power in Pakistan, has grown at an average annual rate of 12.4% over the last three decades, while in the same period, net electricity sales increased by approximately 11 5% per year

### 8.2.1 Policy to encourage private sector investments

In the 1980s, recognizing the importance of the power sector in the economic development of the country, the government increased the allocation of the public sector outlay from 30% to 40% for capacity addition in the generation sector However, with the growth in demand, the investment requirements far exceeded the public sector outlay, thereby necessitating private sector investment In 1985, the government introduced a policy inviting private investment and offered an 18% rate of return on the bulk sale of power to the country's two vertically integrated utilities, Water and Power Development Authority (WAPDA) and the Karachi Electricity Supply Corporation (KESC). The policy however, was unable to generate resources of the required quantum, and was revised in 1994. The power policy of 1994 remains in effect and its main features are outlined below

- A single window clearance facility in the form of the Private Power and Infrastructure Board (PPIB), was set-up as an autonomous organization to liaise with the private investors and assist them with the signing of agreement and receiving approvals from the concerned government departments,
- The introduction of standard, model government-drafted documents based on past letters of support, implementation of agreements, power purchase and fuel supply agreements with clearly defined terms and conditions to diminish the time spent in negotiations.
- A draft of the terms of power purchase agreements, implementation agreements and other project documents covering a 30-year period, depending upon the availability of fuel resources and technology,

- Independent power producers were allowed to choose the technology, fuel and site location, and also to make their own arrangements for the import and transport of fuel, and for the development of port handling facilities,
- Government guarantees were introduced for the payment obligations of the public sector utilities like WAPDA and KESC and state-owned fuel suppliers,
- A fixed price for the bulk purchase of power from the private generators was announced, rather than one subject to negotiations An average price of US $ 0 065/KWh was announced for the first 10 years, and projects with an installed capacity of more than 100 MW were entitled to an additional premium of $ 0.025/kWh The tariff comprised of two components- a capacity price of $ 0 043 cents/kWh calculated at 60% plant load factor and payable on a monthly basis and an energy price of $ 0.022 cents/kWh payable on a delivery basis
- The terms of the contract were also made globally competitive with a reduction in local equity, simplified procedures and steps to create a strong domestic corporate debt securities market,
- Financial incentives for power generation companies including exemption from corporate income tax, customs duty, import license fee and other surcharges for the term of the power purchase agreement, were provided,
- Private power generation companies were allowed to issue corporate bonds and shares at discounted prices to enable a higher rate of return, proportional to the risk,
- Foreign banks were allowed to underwrite the issue of shares and bonds by private power projects,
- The earlier limit of 5% on investment equity in associated undertakings was abolished,
- Private generating companies were allowed to register anywhere in the country to avoid high stamp duties and allow registration of debt documents,
- An independent rating agency was established to enable the bond investors to make informed decisions,

As a result of the power policy of 1994, 127 proposals were received from local and foreign investors for a capacity addition of 26000 MW. The 1292 MW oil-fired Hub River power project is the first and the largest privately financed independent power project in the Indian sub-continent (at an estimated investment of $ 1.8 billion) and provides an excellent example of innovative market assessment, sound negotiations, mutually beneficial tariffs, and a flexibility on the part of the promoters to work with local financial institutions

Though the project was initially constrained by the lack of experience and confidence in a new developing market, it finally reached financial closure in 1995 after a decade of negotiations. The project has provided a good precedence for similar innovative power financing in the future, though the project itself took about eight years to finance and was promoted by National Power of the U K (the power station's major operator), Xenel Industries (Saudi Arabia), and contributors from other Islamic financial institutions, the Commonwealth Development Corporation, The Japan Export-Import Bank, and the World Bank which granted the project the guarantee against political risk

Being the largest power plant in Pakistan in terms of size and capacity, the construction of the plant faced some unprecedented delays, however it has came on stream successfully and is expected to play an important role in reducing the demand and supply gap, thereby contributing to the country's overall economic growth

Financial closure of seven other IPPs followed soon after the Hub River project, thereby adding to the generation capacity in excess of the planned capacity of 2065 MW in 1999/2000. The government has also accelerated plans for the privatization and distribution assets of the existing Kot Addu (1600 MW) CCGT plant near Multan, Jamshoro (880 MW) near Hyderabad, and the Faislabad Area Electricity Board, which covers more than one million consumers in central Punjab. In addition four hydroelectric power projects, Jinnah, Duber Khwar, Allai Khwar and Rohri with a total installed capacity of 445 MW and involving an investment of $ 147 million have been offered to the private sector

According to the new power policy, the government plans to prioritize the development of hydropower projects on a build-own-operate-transfer basis, and coal-based thermal projects on a build-own operate basis The government has received proposals for the generation of 7.5 GW of hydropower in the North West Frontier Province (NWFP). Recently, the Mataltan Hydel Power Company and the provincial government of NWFP, signed an agreement for the construction of a 84 MW hydropower project at Mataltan. The $ 120 million project will be based on the BOOT scheme and will be handed back to the provincial government after 25 years of operation. Table 8.2 provides the status of the private power projects in Pakistan

**Table 8.2 Status of private power projects in Pakistan**

| Name (Promoter) | Fuel/type | Capacity | Status |
|---|---|---|---|
| Baharhi (Liberty Power) | Gas-fired | 235 | Operational |
| Quetta (Nabibullah/Coastal) | Gas-fired | 140 | Operational |
| Port Qasim (Wak Power) | Oil-fired | 450 | Operational |
| Baluchistan (Uch Power Ltd) | Gas-fired | 586 | Operational |
| Bidhnal Barrage (Rausch Power/Siemens) | Oil-fired | 412 | Operational |
| Punjab (Saba Energy) | Oil-fired | 110 | Financed |
| AES Pak Govt. (AES) | Oil-fired | 350 | Operational |
| Hub River (Hub Power Co.) | Oil-fired | 1292 | Operational |
| Lal Pir (AES) | Oil-fired | 337 | Operational |
| Lahore (Kohinoor Electric Co ) | Oil-fired | 120 | Operational |
| Kerangi(Gul Ahmed) | Oil-fired | 125 | Operational |
| Raiwand (Japan Power Generation) | Oil-fired | 120 | Operational |
| Pottweki (Power Generation Systems) | Oil-fired | 116 | Operational |
| Raiwand (Southern Power Water) | Oil-fired | 117 | Operational |
| Manipur (Tristar Energy) | Oil-fired | 110 | Operational |
| Fauji Kabirwala | Gas-fired | 157 | Operational |
| Japan Power | Oil-fired | 120 | Operational |

*Source* Bath D.S, 1998, WAPDA, 2000

The approach of the Privatisation Commission for the privatisation of the power sector is based on a mix of "Strategic Sale" and "Management Contracts" The decision whether to use a Strategic Sale of a Management Contract for a particular transaction is based on the perceived benefits from individual transactions.

Under the Strategic Sale arrangement, a public limited company is formed to acquire the assets and liabilities of the utility to be privatised An equity interest in that company, typically 26% of the equity, is sold to a strategic investor and the strategic investor is given full management control of all key decisions of the company through shareholders' agreement with the former government owner Under the Management Contract agreement, the public sector utility enters into a performance-based management contract with private sector operators in order to improve the operational and managerial efficiency of the utility, while ensuring value maximization for assets to be sold to private investors in the future

Implementation of the restructuring programme is expected bring about a gradual transition from integrated, state-owned utilities to a decentralized system with separate generation, transmission and distribution entities, having substantial private ownership and management, thereby reflecting and encouraging a commercial and competitive operating environment At present, the privatisation efforts focus on WAPDA's distribution sector and the KESC In attempt to privatize the cash-strapped Karachi Electricity Supply Corporation, the Privatization Commission (PC) of Pakistan decided to hand-over the company to the military in an effort to reduce the transmission and distribution losses estimated at about 40% In a move for partial divestment of the KESC, the PC has offered a 26% stake to a consortium of international investors to run the KESC, thereby expecting to generate $ 1 5–$ 2 billion The Asian Development Bank is also expected to provide a $ 250 million loan for the development of the power sector, half of which would be utilized for the restructuring of the KESC, preceding its privatization

The National Electric Power Regulatory Authority, (NEPRA) is also expected to promote fair competition in the electricity industry and to protect the rights of customers as well as producers and sellers of electricity NEPRA is expected to provide investor confidence in the organization and growth of the electric power sector. It should aid in the rationalization of electricity rates and ensure that investment in the electricity industry in justified and earns a reasonable return for the investors

### 8.2.2 Pricing policy

The price of electricity, about 55% of which is generated from oil-based thermal power plants is determined by the Water and Power Development Authority (WAPDA) The tariff is based on an average cost plus pricing formula, with a provision to generate a surplus to self-finance about 40% of the investment in the sector, as per the loan conditions stipulated by the World Bank. Given that the cost of generating hydro-power is lower than that of thermal power, this policy has made the price of electricity artificially low A marginal cost pricing principle has therefore been proposed, so as to recover the costs of thermal power generation, thereby ensuring an economy in the utilization of the high-cost oil-based generation

There also exists a differential in the tariff charged across the consumer categories, with the industrial and domestic consumers cross-subsidizing the domestic consumers. In the agricultural sector, a flat rate is charged for the irrigation tube wells thereby encouraging inefficiency and excessive consumption The pricing structure therefore, needs to be rationalized, to encourage conservation of resources as well as ensure financial viability of the state-owned utilities.

In the recent years the public sector power utilities WAPDA and KESC have been faced with a complex set of problems arising largely from the existing tariff structure, thereby having an adverse impact on the operations and creating serious liquidity problems Some of the key problem areas include (World Bank, 1998):

- Inefficient operations, high T&D losses, deterioration in infrastructure due to inadequate renovation and maintenance
- Non payment of electricity bills, especially from the provincial governments, thereby reducing cash flow
- A highly distorted tariff structure with a heavy subsidy to the agricultural and domestic sectors, and free supply to Federally Administered Tribal Areas and Azad Jammu and Kashmir, resulting in losses of over Rs 30 billion in 1997/98
- Associated over- pricing in the industrial and commercial sector to a point where captive generation may become a more attractive alternative
- The induction of a substantial amount of high cost(compared to WAPDA's existing hydel and other generation facilities) power from the private power producers, which coupled with the slower than expected growth in power demand has placed a financial burden on WAPDA which is obliged to purchase a large proportion of the high-cost power
- The government's policy of not increasing tariffs, which was in effect from February 1997 to March 1998

The government has developed a comprehensive programme to improve the financial condition of the power utilities and thereby improve the operating efficiency Some of these measures include

- A 21% weighted average increase in power tariffs to be followed by the increase in gas prices,
- Reduction of cross-subsidies, by limiting the tariff increase for the industrial and commercial consumers to 14%,
- Settlement of the provincial governments' arrears to WAPDA,
- Formulate a high level Steering Committee to provide guidance and coordination and to accelerate WAPDA's programme of restructuring,
- Creation of a holding company to take over the functions of WAPDA's Power Wing, while leaving the jurisdiction over the irrigation and hydel-power sectors in WAPDA's domain,
- Transformation of the National Electric Power Regulatory Authority into a fully autonomous and effective regulatory agency for the power sector;
- Acceleration of the privatization process in the generation and distribution sectors

The Islamabad Electric Supply Company has introduced the time of day tariff system which provides different rates for specified times, so as to reduce consumption during peak hours. The NEPRA has also approved a 11% increase in tariff as recommended by the WAPDA. This was viewed as necessary to raise about Rs 15.377 billion to recover the financial losses, and for reducing the subsidies as a part of the pricing reform. The KESC has also sought approval from the NEPRA for an increase in the tariff by 11 52% so as to enable a reduction in the technical losses in transmission and distribution Meanwhile the IMF has asked the government to increase power tariffs by at least 15% to qualify for the $ 150 million for the development of the power sector.

In the case of bulk tariffs for power purchased from private generators a tariff of $ 0.065 has been fixed which allows a minimum of 18% return on equity However, in 1998/99 the IPPs have encountered some problems with the government over the tariffs set in the power purchase agreement with the WAPDA In response to the government's demand for the reduction in rate, the IPPs have demanded a reduction in the price of fuels, particularly for oil supplied by the state-owned monopoly The Economic Coordination Committee has approved the memorandum of agreement signed between the Water and Power Development Board and six IPPs on reduction of tariffs by 4% subject to certain conditions

### 8.2.3 Success of the privatization policy: a comparative analysis

The success of private power projects in Pakistan can be attributed largely to the political will and strategic planning undertaken by the government for restructuring and privatizing the power sector (Table 8 2) The National Electric Power Regulation Authority, facilitated the monitoring and implementation of private projects Also the government's role in granting direct and indirect finance to projects through the establishment of the Private Sector Development Fund provided the essential infrastructure without delays

While both India and Pakistan have embarked upon a policy to introduce fast-track private power projects, the success in the case of India has been quite limited so far. Some of the factors that can be attributed to the delays in the implementation of private power projects in India are

Though efforts are underway to streamline the process of approval, multiple agencies responsible for clearances result in bureaucratic delays,

- While in Pakistan the government has guaranteed the currency convertibility and payment obligations of its electricity boards and state-owned fuel suppliers, in India only fast track projects receive government counter-guarantees to meet the payment obligations of the SEBs,
- In Pakistan, the standard tariff constituting the capacity and energy components is indexed on the basis of the inflation rate in the US, the future devaluation of the rupee and fuel price variations The capacity payment offered on a 60% PLF insulates the project from variations in the amount of energy purchased by providing enough revenue for debt servicing, operations and management, and a return on equity of at least 18%. In India however, the project promoter is granted a post-tax return of 16% on equity with the plant operating at a PLF of 68 5% and in the absence of a standard tariff where the tariff rates are negotiated by the SEBs

References.

1 Bath D S 1998 *Indian Power Projects· Regulation Policy and Finance.* Hong Kong: Asia Law and Practice Publishers

2 EIA 1999 *Country Analysis Briefs* Energy Information Administration United States Department of Energy

3 GoP 1998 *Pakistan Energy Yearbook* Hydrocarbon Development Institute of Pakistan. Ministry of Petroleum and Natural Resources Government of Pakistan Islamabad

4 WAPDA 2000 *Power and Energy Fact File* Water and Power Development Authority Pakistan

5. WEC 1999 *Financing the energy sector in developing countries.* World Energy Council, 1999 New Delhi

6 World Bank 1998 *Pakistan Economic Update Adjustment and Reforms for a Better Future* World Bank

# Chapter 9: Energy policy in Bangladesh

## 9.1 Oil and gas

In Bangladesh the Ministry of Energy and Mineral Resources (MEMR) has the overall responsibility for policy formulation and investment decisions in the energy sector. Natural gas is the only significant source of commercial energy in Bangladesh, with an estimated reserve of about 11 tcf. However, foreign companies that have engaged in gas exploration and production in Bangladesh believe that the actual reserves may be much higher The search for indigenous energy sources has also led to coal mining, even though the coal reserves are lying deep and require expensive deep shaft mining Coal production is estimated at about 1mt in 2000 and would be utilized primarily in a 300 MW power generation plant

The government of Bangladesh formulated the National Energy Policy in 1995 with the objective of guiding the development of the energy sector till the year 2020. Some of the main features of the policy are (ADB, 1995)

- Facilitate the optimum development of the energy resources in the country
- Modify existing laws and provide incentives for inviting private sector participation in the development of energy resources, with uniform incentives for the public sector companies
- Corporatize the Public Sector Utilities to improve their management and financial performance.
- Establish a regulatory authority for the planning and coordinating the private sector participation
- Establish environmental laws, regulations and standards to be incorporated in the energy sector development programmes
- Develop infrastructure facilities for energy supply to the under-developed West Zone and rural areas
- Develop an import policy to bridge the gap between demand and supply
- Develop a programme for the development of renewable energy sources
- Enactment of the Energy Conservation Law providing incentives for rational and efficient use of energy

The National Energy Policy of Bangladesh advocates an increase in the use of natural gas so as to reduce the dependence on oil import, which is expected to increase from 20% in 1997/98 to about 80% in the year 2020. The consumption of imported fuels has been restricted to only those end-uses such as the transport sector, where no other alternatives exist. However the government is encouraging the use of CNG as a transportation fuel with the objective of reducing the oil import bill by an estimated $ 350 million

In an effort to develop the energy resources in Bangladesh, the US government has signed an Energy Cooperation Agreement with the government of Bangladesh The objectives of the agreement are outlined below.

- Exchange of energy information and development of a training program designed for the collection and analysis of energy data
- Examine a wide range of priority projects and investment options for the development of the natural gas reserves
- Provide technical, financial and legal support to Bangladesh to implement the strategically important Western Region Integrated Project (expected to receive an investment of $ 600 million from Unocal), which proposes to integrate the development of the gas resources in the south-western part of the country (centered around the Shabazpur gas field), develop a 150km gas transmission pipeline to Southern Khulna, and construct four power plants with a generation capacity of 400 MW

The government is also seeking a $ 80 million loan from the ADB to launch a natural gas development programme The loan comprises two components, covering the implementation of sector reforms and expansion of the north-south pipeline In addition, the government proposes to develop a policy on private sector participation in gas transmission and establish an independent Gas Regulatory Authority

### 9.1.1 Policy for upstream investments

The gas sector, in Bangladesh offers a unique opportunity for attracting large-scale foreign direct investment The close proximity to markets in India and Pakistan, gas in Bangladesh is expected to have a competitive advantage over other potential supplies from the Persian Gulf or Central Asia However, developing the gas industry may place a burden on the balance of payments, since a significant portion of profits may be repatriated to the investing countries once production comes on line and development of the industry would require extensive imports The government needs to take these factors into consideration in formulating a gas utilization policy (EIA, 1999).

Until the early 1990s the state-owned Petrobangla, along with its 8 operating companies was the sole operator in the oil and gas sectors Petrobangla currently produces about 250mcf/d of gas from the Habiganj and Rashidpur fields, which have an estimated reserve of 3-4tcf. Even though the Petroleum Act of 1974, allowed for private sector participation in gas exploration and production in the offshore areas, not much progress was made in attracting foreign investments, leading to the formulation of a more liberal policy in the early 1990's resulting in four new PSCs. 23 exploration blocks have now been offered to private investors for production sharing contracts (PSCs) At present, Occidental, Cairn Energy PLC, Holland Sea Search, Unocal, Rexwood-Okland and UMC Bangladesh Corporation are actively involved in exploration

In July 1998, Cairn Energy discovered a large gas reserve in the Halda valley, and has been awarded other exploration blocks as well Meanwhile Unocal and Occidental, along with Petrobangla have been jointly involved with the development of the 1 6 tcf Jalalabad gas field, which began production at the rate of 100 mcf/d in March 1999 The Jalalabad gas field is expected to supply 100 mcf/d of gas, which would be carried to the gas processing plant at Alurtal, before it is supplied to the national grid Unocal has recently been awarded exploration rights in the Shabazpur gas field Petrobangla in collaboration with BAPEX also plans to invite foreign investment for the development of discovered gas fields that remain undeveloped partially due to lack of investments.

The foreign investors have entered into PSCs with Petrobangla, covering a seven period, with a production development plan of 20 and 25 years in case of oil and gas fields respectively Petrobangla is responsible for regulating the activities of the foreign companies and serves as the sole purchaser of oil and gas from these companies The companies are liable to supply a maximum of 25% of the oil at a 15% discount and the remaining if required at market prices in convertible currency The government is responsible for assuring a market outlet within six months of commercial discovery of gas failing which the companies would be free to find a market outlet within the country The companies are also allowed to export gas in the form of LNG, subject to negotiations with the government, and any surplus oil after meeting the domestic requirements.

### 9.1.2 Policy for downstream investments

Bangladesh Petroleum Corporation (BPC) and its subsidiaries control the refining, import, marketing and distribution of all petroleum products. The Eastern Refinery is the only refinery in the country with a capacity of about 1.5 mt.

Other than marketing and distribution, private sector investment is being allowed in all other activities in the downstream sector About ten private LPG bottling plants for imported LPG are in different stages of development. A joint venture has also been formed with the Jamuna Oil Company, a marketing and distribution subsidiary of the BPC, for the installation of a lubricant blending factory

The national energy policy has provided a set of guidelines for private investment in the refining and marketing & distribution sectors. According to the guidelines, the private sector has been allowed to set-up new refineries, and install secondary conversion units for upgrading the residual fuel in the existing refinery In addition, investments are being invited for the development of infrastructure related to construction of pipelines and storage facilities, and also the import and distribution of petroleum products. Joint venture companies are being encouraged in the downstream sector and would be provided the benefits of the Foreign Private Investment (Promotion and Protection) Act, 1980

The pricing formula for the petroleum products is based on import parity prices with a negotiated discount, and the refineries will be free to sell their products to any marketing company or directly from the plant to any customer within the country

### 9.1.3 Pricing policy

The producer's price for non-associated gas has been fixed at 75% of the international price of high sulphur fuel oil, subject to negotiated discounts Offshore gas is priced 25% higher than that from onshore areas At present Petrobangla is the sole purchaser of gas, and the experiences of the private companies such as Cairn and Occidental suggests that there is an uncertainty regarding Petrobangla's ability to pay for private operated gas from the Sangu and Jalalabad gasfields Currently, Petrobangla loses money for every unit of gas that it purchases from the private operators as the purchase price from these fields is much higher than the average sales tariff The only viable solution to the problem is to rationalize the consumer tariffs, which has always remained a politically difficult task to accomplish

However, the government has taken the decision to increase the price of natural gas supplied to the Power Development Board from $ 2 1 to $ 2 4/mmbtu, thereby reducing the subsidy component The PDB will therefore need to increase its productivity and efficiency, which at present is only 25% as compared to the private units which have an efficiency of about 45%.

### 9.1.4 Augmentation of transport infrastructure

The newly formed Western Region Gas Company will begin supplying gas to the north-western region following the completion of the pipeline project implemented by the gas Transmission Company Limited connecting this region with the main natural gas network. The project comprises of 9 km gas transmission pipeline along the Bangabandhu and a 28km pipeline from Elena to Baghbari through the Bangabandhu bridge In addition distribution lines for Sirajganj and its surrounding areas have also been constructed Under the plan the gas pipeline will be further extended to Bogra, Ishurdi, Pabna, Paksey, Bheramara and Rajshahi in the second phase and to Rangpur and Dinajpur subsequently The northern segment would be linked to Khulna and Jessore and integrated with the national gas grid The total cost of the project is estimated at $ 44 million with $ 29 million of foreign investment.

In view of the bottlenecks in the existing gas transmission system and the need for augmentation of capacity to meet future energy supplies, Unocal has proposed a project centred around Shahbazpur, estimated at $ 250 million, including a gas pipeline system to serve the gas fired plants in western Bangladesh Other companies that have recently been awarded exploration blocks include the Irish oil and gas exploration and production company,Tullow Oil PLC in partnership with Chevron, Texaco and Malaysia's Petronas

In July 1998, Mobil Oil and Jamuna Oil Company of Bangladesh signed two joint ventures contracts for construction of a LPG import facility and a lubricant oil blending plant at Chittagong port, at an estimated cost of $ 25 million.

## 9.2 Power

At present three state-owned utilities under the Ministry of Energy and Mineral Resources are responsible for the development of the power sector in Bangladesh These utilities include the Bangladesh Power Development Board (BPDB), responsible for power generation and transmission in the entire country, and distribution to the urban areas other than the Greater Dhaka area; the Dhaka Electric Supply Authority which is responsible for distribution in the Greater Dhaka area including the city of Dhaka; and the Rural Electrification Board, which is responsible for distribution in the rural areas.

The Power System Master Plan has projected a power demand of 16500 GWh by the year 2000 and 24160 GWh by the year 2005, thereby necessitating a capacity addition of about 3 1 GW by the year 2000 and 3 3 GW by the year 2005, at an estimated cost of $ 4.4 billion The investment required for the corresponding expansion of the transmission and distribution system is estimated at $ 2 2 billion

The likelihood of securing an investment as large as $ 6.6 billion for the development of the power sector from the public sector alone is quite low, moreover, the competing demands on the government resources and declining levels of assistance from the bilateral and multilateral agencies has necessitated private investments The government has therefore introduced a policy encouraging power sector reforms and private sector participation for power generation

### 9.2.1 Policy for private sector investments

Given the large investments required to meet the country's power demand, the government issued the Private Sector Power Generation Policy of Bangladesh, in 1996, inviting bids from IPPs on the BOO basis for power generation projects In order to implement the policy, the government set-up the 'Power Cell' under the Ministry of Energy and Mineral Resources, to facilitate the electricity reform and restructuring process and conduct studies on electricity tariffs The government has also drafted an Electricity Reform Bill for the restructuring of the power sector The Bill is currently under review and is expected to be enacted soon The Act provides for an Energy Regulatory Commission which would regulate the purchase, generation, transmission, distribution and utilization of electricity It would also regulate tariffs, and private investments in the power sector

At present the Power Cell is responsible for the promotion, development, implementation and commissioning of private power projects The contracts for private power projects have been provided with a 'single-window' clearance by the Power Cell which solicits, evaluates, and awards the contracts The Power Purchase Agreement would be provided with a guarantee for performance obligations of the concerned utilities In case the fuel is supplied by a public sector company, the performance of the fuel supplier will be guaranteed by the government under the Fuel Supply Agreement

The financial arrangements for the IPPs are outlined below

- The funds for the project will be raised without with any sovereign guarantee of repayment. The investors and developers must therefore examine the revenues earned from sales for debt servicing and returns on equity
- Equity investment has been stipulated at a minimum of 20%
- The government proposes to establish a Private Sector Infrastructure Development Fund with the assistance of the World Bank and other aid agencies to provide a part of the capital, at market based interest rates
- To facilitate the creation of a corporate debt securities market essential for raising finances locally, the power generating companies have been allowed to issue corporate bonds and shares

The fiscal incentives include

- The private power companies are exempted from corporate income tax for a period of 15 years
- Equipment import is exempted from customs duty
- Repatriation of equity along with dividends is allowed
- Foreign lenders are exempted from income tax in Bangladesh
- Foreign investors may form joint ventures, however this has not been laid down as mandatory
- The power sector has been declared as an industry thereby making it eligible for all concessions available to other industrial projects

As a result of the policy outline in the preceding paragraphs, a number of fast track barge mounted plants, as well as two gas-fired combined cycle plants are scheduled to be commissioned in 2000 and 2001 The private sector is expected to add 1200 MW while the public sector is expected to add 1000 MW of power generation capacity, by the year 2002 The government also plans to privatize the distribution system, subsequently

The sixth power generation unit of the Ghorasal Thermal Power Plant, the largest power plant in Bangladesh, with an installed capacity of 210 MW constructed by the Russian company Technopromexport, commenced operation recently Power supply from the new plant would boost the country's power generation capacity to 2550 MW Also the 115 MW barge mounted power plant at Haripur has commenced operation 95% of the power generated is gas based while 5% is based on diesel.

Hyundai Engineering and Construction Limited have been awarded a contract for the construction of two power plants with generating capacities of 365 MW and 450 MW The construction of the power plants is expected to be completed by the year 2002 with an estimated investment of $ 350 million.

The PDB has signed a contract with the China Hydro Power Engineering Corp for the construction of a 450 MW combined cycle plant at Meghanat

Occidental in collaboration with the National Thermal Power Corporation of India has proposed the construction of a new 1000 MW gas fired power plant, with the gas supplied from the Bibiyana gas field located in north-eastern Bangladesh

### 9.2.2 Pricing policy

The power produced by the IPP is purchased by the state-owned utilities, according to the PPA The tariff structure comprises of the capacity and energy components The bidders are required to offer bulk power tariff based on the capacity and energy payments

The capacity component comprises of the return on equity, debt service, and fixed operation and maintenance costs The capacity payment has been divided into an escalating and non-escalating component The payments would be made in the local currency (Taka) but denominated in both the local and foreign currency The energy component would include variable costs of operation and maintenance, including the fuel costs and would be payable in Taka

### 9.2.3 Augmentation of transmission and distribution infrastructure

The Power Grid Corporation of Bangladesh (PGCB), is responsible for the power transmission and distribution The company has taken over the Hariput-Comilla Grid sub-station and the 45 km Haripur-Ghorashal transmission line from the Power Development Board and will take charge of the Hasnabad sub-staion and the 40 km transmission line in June 2000

PGCB is expected to charge a higher transmission tariff than the PDB The power transmission rate will be increased to $ 0 36 /kWh, thereby increasing the revenue to about

$ 405,000/month of which PDB will pay about $ 397,000 to the Dhaka Electric Supply Authority and $ 6303 to the Rural Electricity Board.

The PDB and Samsung Corporation of South Korea have also signed an agreement for the augmentation of power supply under the Greater Khulna Power Distribution Project. The turn-key contract covers the construction of 33/11kV sub-station, the renovation of existing sub-stations, the construction of a 21km, 33 Kv power transmission line and 1 km, 33kv underground transmission cable The total cost estimated for the project is $ 8 million of which 90% would be provided by the Export-Import Bank of South Korea and the remaining 10% would be provided by the government of Bangladesh

RPG Transmission limited, of India has also signed an agreement with the BPGC for the construction of 230kV transmission line to supply 450 MW of power from the Meghanaghat power station to Dhaka The project is being financed by ADB and is estimated to cost $ 7.7 million

## 9.3 Renewable energy

### 9.3.1 Policy encouraging private sector investments

In Bangladesh 85% of the population lives in the rural areas, with scarce access to conventional energy resources At present only 15% of the total population has access to electricity There is therefore a significant potential for developing renewable energy technologies to meet the basic energy requirements of the rural population (GoB, 1999) A Renewable Energy Development Programme has therefore been launched, in areas with potential for renewable energy resources, taking into account the technological and economic feasibility of projects The government also proposes to establish the Energy Regulatory Commission (ERC) that will be responsible for the implementation of the renewable energy policy Until the establishment of the ERC, the MEMR has been designated as the nodal agency for the coordination, monitoring and implementation of the renewable energy programme as outlined below:

- Identify and assess the potential of projects
- Assist in the issuance of licenses for commercial projects sponsored by private entrepreneurs
- Recommend financing and delivery mechanisms to increase affordability amongst the poor segments of the population
- Promote participation from the private sector and NGOs

- Recommend institutional requirements for the successful implementation of the projects
- Identify the requirement for capacity building
- Facilitate technology transfer for the commercialization of RETs

The government has provided a security package comprising the model Implementation Agreement, Fuel Supply Agreement, Waste Supply Agreement for the supply of jute and sugarcane bagasse, firewood etc, and Power Purchase Agreement for the purchase of bulk power from the project sponsors In addition, a provision has been made for the purchase of power at a specified voltage level from renewable energy projects with automatic changeover systems for connecting with the supply grid The costs of interconnecting facilities for supply to the grid will be borne by the purchaser, however, the control over the power transfer system shall be with the power purchaser and may be facilitated by a mutual agreement between the purchaser and producer

Inadequate investments remain a major constraint in the development of RETs The renewable energy policy recently announced by the government therefore, emphasizes on encouraging both public and private sector investments, through innovative financing options In this respect, some of the financial arrangements that have been proposed by the government include

- Since Bangladesh is a signatory to the climate change convention, the government may establish a Global Environment Facility grant fund to support the development of RETs
- GoB may allocate funds to a few local banks for financing the capital costs
- To encourage local financing of projects the following provisions have been made by the government
    - The companies may be allowed to issue corporate bonds with the consent of the Securities and Exchange Commission (SEC)
    - A discount of upto 10% may be allowed by the project sponsor
    - Underwriting by foreign banks would require the consent of the SEC
    - Tax facilities have been provided for private sector investors

Some of the fiscal incentives that have been introduced to encourage investments include

- Sponsors of renewable energy projects have been exempted from corporate income tax for a period of 15 years from the date of commercial operation of the project

- 100% depreciation in the first year for solar energy based technologies, and 100% depreciation in 5 years for wind, biomass, geothermal and hydro power projects
- The sponsors will be exempted from customs duty, value added tax and other surcharges on importing equipment other than that manufactured indigenously and complying with international standards
- The repatriation of dividends will be allowed, however the dividends will be taxable
- The foreign investors will be free to form joint ventures
- Private power companies will be allowed to buy insurance according to their requirements
- Tax exemption on royalties, and technical assistance fees for foreign investors
- Tax exemption on interest on foreign loans
- Tax exemption on capital gains from transfer of shares for investing companies
- Provisions for avoiding double taxation in the case of foreign investors
- Provision for transfer of shares from foreign shareholders to local investors
- Full convertibility of the taka for international payments
- Provision for re-investment of remittable dividend to be treated as new foreign investment

The proposed tariff structure for the power generated from renewable energy projects is outlined below

- The tariff would include debt service, return on equity, fixed and variable operation and maintenance costs, and insurance costs The costs will also take into account the taka-dollar conversion fluctuation
- The payment will be linked to a certain level of availability of power which will be made available at the time of the PPA
- Though the tariff payment will be made in takas, the PPA may include tariffs in dollar terms
- The private sponsors will provide an annual tariff profile, in a manner that will match the debt-service requirement

**References:**

1. ADB. 1995. *Natural Gas Potential: South Asia Summit* Asian Development Bank New Delhi
2. EIA. 1999 *Country Analysis Briefs* Energy Information Administration United States Department of Energy
3. GoB 1999 *Renewable Energy Policy of Bangladesh* Ministry of Energy and Mineral Resources Government of Bangladesh Dhaka
4. WEC 1999 *Financing the energy sector in developing countries* New Delhi

# Chapter 10: Key National and International Players in the Energy Sector

## 10.1 National companies

### 10.1.1 National Thermal Power Corporation

The National Thermal Power Corporation (NTPC) is a central sector generating company for the development of the thermal power sector in India The corporation is involved with the setting-up of coal and gas based projects NTPC's growth strategy constitutes a multi-pronged approach for capacity addition to augment its share in the power generation capacity through green field projects, expansion of existing plants, acquisitions of SEBs and joint venture projects The corporation is also focusing upon efficiency improvements and environment management in the existing and new plants

Recently, NTPC has initiated action for setting-up of hydro-power projects in Uttar Pradesh as well as wind-based power projects in the southern states of Tamil Nadu and Kerala The corporation has entered into joint ventures with ABB and Kraftwerke AG, Germany for the renovation and modernization of existing plants The government is also considering the merger of the NTPC and the National Hydro Power Corporation, through the creation of a holding company and issuing fresh equity of shares in these companies

### 10.1.2 Powergrid Corporation of India

Powergrid is playing a vital role to bridge the widening gap between energy demand and supply, by making the most economical use of the available resources. The engineering expertise includes the implementation of highly specialized areas of 800 KV AC systems, 500 KV HVDC bipole and back to back stations, 400 KV AC transmission system and gas insulated sub-stations

Powergrid is providing a high priority to the integration of the regional grid to form a national grid The company envisages an investment of 13000 crores for its identified ongoing schemes and new schemes during the Ninth Five Year Plan Powergrid will be instrumental in restructuring the Indian power sector and will continue to act as an agent of change to motivate and catalyse development in the power transmission and distribution sectors

### 10.1.3 Water and Power Development Authority (WAPDA)

WAPDA was established in 1958 and entrusted with a massive agenda that includes generation, transmission and distribution of power along with irrigation, water supply and drainage, flood control, internal navigation etc At present, it owns 67% of the country's total power generation capacity, services 80% of all consumers and is the principal power generation and supply system in Pakistan

WAPDA's distribution network is divided in eight Area Electricity Boards (AEBs) The AEBs were created as departments within WAPDA to administer the supply and distribution construction, expansion, maintenance and management of the system These AEBs have an annual sale of over 37,000 kWh and earn a revenue of over Rs 76,000 million The government of Pakistan intends addressing the future needs of the country by gradually restructuring the system from an integrated utility to a decentralized scheme based on a wholesale competition model

### 10.1.4 Karachi Electric Supply Corporation

Karachi Electric Supply Corporation (KESC) is a vertically integrated electricity utility responsible for the generation, transmission and distribution of electric supply in Karachi and certain adjoining areas KESC was incorporated in 1913 After Pakistan's independence in 1947, the government of Pakistan (GOP) began acquiring a majority stake in the corporation and today its direct and indirect share capital has risen to 80% KESC is listed on all three stock exchanges of the country

It has a consumer base of 1 3 million predominantly urban consumers while the total population in its licensed area comes to over 10 million The total licensed area of KESC is 6024 34 square km, covering Karachi Division, the industrial part of Thatta District and part of Lasbela District in Balochistan Karachi however accounts for the bulk of the power consumption

The privatisation of KESC constitutes an important element of the government's ambitious agenda of restructuring and privatizing the power sector in Pakistan KESC's privatisation is being done on priority basis and expressions of interest from potential investors are being solicited

### 10.1.5 Oil and Natural Gas Commission

ONGC is the largest state-owned company in India, engaged in the exploration and production of oil and natural gas One of ONGC's achievements include deep underwater exploration in the Krishna-Godavari Basin in the Eastern offshore region This is the second such well of its kind, the first being in the Cauvery Basin ONGC has also bagged drilling contracts in Bangladesh and Oman. ONGC Videsh Limited, a wholly owned subsidiary of ONGC, is engaged in the overseas ventures, including the acquisition of acreage and E&P operations. These operations include gas exploration in Vietnam, and acquisition of acreage in Kazakhastan, Azerbaijan and Iraq.

### 10.1.6 Pakistan Oilfields Limited

POL's average oil and gas production from its 100% owned fields during the year 1996/97 was 1,464 barrels per day and 10 million cubic feet of gas per day, respectively. The major share of POL's production is from the Meyal field. Operations on two wells in Dhulian were successfully completed which resulted in enhancing the production The 3-D seismic data acquired in Balkassar is being processed and based on the interpretation of results, the company plans to carry out drilling of a horizontal well subject to finding a suitable location and its economic viability. The company also operates joint venture fields Recently, a development and production lease was granted to Tullow Pakistan Limited for the Sara field Negotiations with Water and Power Development Authority (WAPDA) for the gas sales agreement are in progress, however the operator (Tullow) is exploring an alternative outlet for Sara gas in case an agreement with WAPDA is not concluded Tullow has also successfully tested gas in three zones at Suri-1 exploratory well and has applied for the license for the Suri gas field

### 10.1.7 Sui Southern Gas Company (SSGC)

SSGC is a large integrated gas company in Pakistan It was formed in March 1989 following the merger of two companies, the Sui Gas Transmission Company, and the Southern Gas Company Ltd SSGC's operations extend from purification of natural gas, to its transmission and distribution to industrial, commercial and domestic consumers in the provinces of Sindh and Balochistan The total gas sales in 1996-97 were 4,928 million cubic meters. SSGC has a total of 2486 km of transmission lines, and 17,238 km of main and service lines The share-holding pattern, comprises foreign investors, 5 65%, federal government, 70.4%; financial institutions and banks, 19 9%; others, 4%. The total assets of SSGC in June 1997 were Rs 28.6 billion, with a paid-up capital of Rs.4billion and reserves of Rs 2 016 billion. The government envisages a divestment of 26% of its stake in the company.

### 10.1.8 Petrobangla

In Bangladesh, until the early 1990s the state-owned Petrobangla, along with its 8 operating companies was the sole operator in the oil and gas sectors. Petrobangla currently produces about 250mcf/d of gas from the Habiganj and Rashidpur fields, which have an estimated reserve of 3-4tcf Unocal and Occidental, along with Petrobangla have been jointly involved with the development of the 1 6 tcf Jalalabad gas field, which began production at the rate of 100 mcf/d in March 1999 Petrobangla in collaboration with BAPEX also plans to invite foreign investment for the development of discovered gas fields that remain undeveloped partially due to lack of investments Petrobangla is responsible for regulating the activities of the foreign companies and serves as the sole purchaser of oil and gas from these companies.

## 10.2 International companies

### 10.2.1 Unocal

South Asia has been a core area of interest for Unocal The asset swap with Occidental has boosted Unocal's access to reserves in Bangladesh that could provide a crucial link for its long-term plan to serve the gas market in India The hold on reserves in the north-east of Bangladesh combined with reserves in the Shahbazpur field places the company in a strong position to develop a fully integrated gas business in the region The company operates in Bangladesh through its wholly owned subsidiary Unocal Bangladesh Limited and has adopted a two-pronged strategy of satisfying the local energy requirements thereby consolidating its position in Bangladesh, and exploring the option of exporting gas to India through a pipeline Recently, the company has proposed an underwater pipeline from Bangladesh to Andhra Pradesh and a surface pipeline to Delhi via Calcutta, at an estimated investment of $1 2 billion In case the pipeline projects materialized the company has also expressed interest in the setting-up of infrastructure for marketing the gas in India At present Unocal is actively pursuing three projects in India, the 200 MW liquid fuel/gas based power plant at Bidadi in Karnataka, the 1800 MW power project in Tamil Nadu, and a 2 5 mtpa regassification facility at Ennore In addition, Unocal is also acquiring 26% equity interest in Hindustan Oil Exploration Company and is evaluating the prospects of exploring gas resources in Gujarat and Assam

### 10.2.2 Tullow

Tullow's interest in India and Pakistan stems from the realization that the region is a fast growing market with a robust demand for gas in the power generation sector Through three separate deals with Larsen and Toubro, Okland oil Company and a consortium of Essar Oil and Hindustan Oil Exploration Company, Tullow has successfully increased its acreage holding to 6 PSCs and a net acreage of 19808 square kms, making it the largest foreign operator in India, in terms of acreage Tullow has also been alloted two blocks on a nominal basis under the 2nd bidding rounds in Bangladesh

### 10.2.3 Enron

Enron has been involved in a global network for the construction and operation of power plants and gas pipeline infrastructure The company has continued to diversify its operations and identify opportunities to meet the energy requirements in South Asia, in a cost-effective, efficient and environment-friendly manner

On May 1999, the company announced the financial closure of its 1444 MW power plant at Dabhol in the state of Maharashtra in India The first phase of the plant is designed for multi-fuel operation, and can be fuelled using naphtha The second phase of the plant is in the process of construction and is expected to use LNG imported from the Middle east Enron is also planning to invest $150 million through a company Enron Energy Marketing Limited (EEML) for importing and marketing LNG in India The company has already set-up a wholly owned subsidiary Metgas to build and operate a pipeline distribution system from the LNG terminal at Dabhol. Of the total approved foreign equity of $500 million, Metgas will require $350 while $150 million will be pumped into EEML

### 10.2.4 Shell

Shell is the world's largest oil company and is involved in oil exploration and production, gas transmission, power generation, chemicals, and petroleum products operations all over the world Under the privatization policy of the Government of India, the company plans to bid for equity in public sector undertakings in the oil sector In this respect the company has expressed interest in acquiring equity in the downstream oil company Bharat Petroleum Corporation Limited (BPCL) since it already has a joint-venture with BPCL in the lubricants sector. The company has however ruled out the possibility of investing in the refining sector which under the existing policy is a pre-condition for entry into the retail sector Shell has recently signed an MoU with the government of Gujarat for building an LNG terminal at Hazira at an estimated investment of $ 44 million

In Bangladesh Shell is involved in the development of gas fields in both onshore and offshore areas, the most important being the Sangu gasfield. In Pakistan, the company is involved in the development of offshore gas fields.

# Chapter 11: Integrating energy markets in South Asia

## 11.1 The imperatives for integrating energy markets

The imperatives for integrating energy markets in South Asia stem from the fact that there exists a significant variation in the resource availability and the technological skills to harness these resources within the region Also there exist large economic benefits in pooling of resources, thereby, reducing the cost per unit of energy, as illustrated in the following sections

Based on the analysis of future energy demand and supply in South Asia, it is evident that energy imports from outside the region are expected to increase substantially Even though, the oil production costs in the Middle East are lower than that in Central Asia, an increasing import dependence on the Middle East has raised concerns relating to the security of supply, thereby necessitating the need for fuel diversification and diversification of the source of the fuel itself In this respect, the oil and gas rich Central Asian region, which has the advantage of geographical proximity to South Asia assumes great significance. However, inadequate infrastructure, and investments in production and technological upgradation have greatly constrained the development of hydrocarbon resources in the Central Asian region There is therefore immense potential for the upstream oil and gas companies to invest in exploration and production in the region and develop it as an alternative to indigenous resources that are fast depleting Similar initiatives are required in the oil and gas rich South-east Asia and the Middle East

Given the high growth rate in the demand for natural gas, which has emerged as a preferred fuel due to environmental considerations as also economic considerations, the implementation of gas pipeline projects from Central Asia and the Middle East need to be pursued in a coordinated manner to serve the energy requirements of the entire South Asian region

Similarly, in the power sector, there exist several opportunities for utilizing the water resources of Bhutan and Nepal and importing the surplus electricity generated, in exchange for technical and financial assistance. In the case of Bangladesh, given the large prognosticated reserves of gas, it would be worthwhile to examine the options of setting-up gas pipelines vis-a-vis power generating plants in Bangladesh and exporting the surplus power to India. Considering the success of independent power producers in Pakistan, there exists significant economic benefit in exporting the surplus power to India, which has been analyzed as being technologically feasible but a remote possibility due to geopolitical constraints.

Therefore, as is evident from the preceding paragraphs there exist several opportunities, which are both economically and technologically feasible, for integrating the energy markets in Asia, however the development of projects and their implementation are entirely dependent on the policy framework and political will of the countries in the region

## 11.2 Exploring the oil and gas markets in Central Asia

The political and economic liberalization of the Soviet Union in the mid 1980s, has catalyzed the process of foreign investment in the Central Asian[1] region, particularly in the oil and gas exploration and production sectors Estimates of the proven oil and gas reserves in the region vary between 15 b-40 barrels (b) and 6 7-9 2 trillion cubic metre (tcm), respectively (Table 11 1) This represents about 1 5% and 6% of the world's oil and gas reserves, respectively However, since much of Central Asia remains unexplored the actual reserves may be higher Even though the Middle East reserves are much larger and account for 65% of the world's proven oil reserves and 30% of the proven gas reserves, the Central Asian region provides an important option for diversification of the fuel supply source Also the Middle East accounted for almost 40% of the internationally traded oil in 1996/97 and this figure is expected to increase in the future, thereby raising energy security concerns in the context of oil supply disruptions due to political instability and a monopolistic control on the global oil prices

The IEA has projected that if foreign investment in the production and development of export outlets continued at the current pace, oil production from the region would reach 79 metric tonne (mt) or 1 6 million barrels per day (mb/d) by 2000 and 194 mt or 3 9 mb/d by 2010 In the low growth case, which assumes some project delays, oil production is estimated at 69mt (1 4 mb/d) by the year 2000 and 138 mt (2 8 mb/d) by the year 2010

Gas production in the region would depend upon the development of export markets in Europe and South Asia, the outcome of the negotiations with Russia for allowing access to the Gazprom pipeline, and the development of new pipeline infrastructure for export Based on these factors the IEA has estimated the gas production at 112 billion cubic metre (bcm) by 2000 and 201 bcm by 2010 in the high growth case and 102 bcm and 164 bcm by the year 2000 and 2010, respectively in the low growth case.

---

[1] The Central Asian region refers to Azerbaijan, Kazakhastan, Turkmenistan, and Uzbekistan.

**Table 11.1 Oil and gas production in the Central Asian region**

| | | 1996/97 | 2000/01 | 2010/11 |
|---|---|---|---|---|
| Oil | mt | 43 | 69-79 | 138-194 |
| Gas | bcm | 96 | 102-112 | 164-201 |

*Source* IEA, 1998

Assuming that the pipeline and other infrastructure projects are completed according to schedule, and taking into account the domestic consumption, it is estimated that the oil and gas available for export from the region would be about 33 mt and 31 bcm respectively by the year 2000/01 and these figures may increase to 117 mt of oil and 84 bcm of gas by the year 2010/11 (Table 11 2)

**Table 11.2 Oil and gas exports from the Central Asian region**

| | | 1996/97 | 2000/01 | 2010/11 |
|---|---|---|---|---|
| Oil | mt | 15 | 29-33 | 75-117 |
| Gas | bcm | 25 | 26-31 | 72-84 |

*Source* IEA, 1998

### *11.2.1 Prospects for oil exports*

The lack of adequate export infrastructure stemming from the various technical, financial, legal, and political difficulties is probably the most serious constraint facing the oil and gas industry in Central Asia Moreover all the existing pipelines inherited from the Soviet Union, pass through Russia and are subject to capacity constraints due to technical and maintenance problems, as well as reluctance for the sharing of infrastructure. The construction of new export pipelines has therefore assumed importance keeping in view the large potential for oil and gas exports from the region. Most pipelines would however pass through politically unstable regions such as Afghanistan, and this has raised some concerns regarding the security of supply.

Unocal of the US and the Delta Oil Company of Saudi Arabia, have proposed the construction of the Central Asian Oil Pipeline (CAOP), for exporting crude from Chardzhou in Turkmenistan, via

Afghanistan to a terminal on the Arabian Sea coast in Pakistan, with a possible extension to India The pipeline may also be connected with the oil fields in the Amu Darya basin in Uzbekistan as well as the Kumkol field in central Kazakhastan The pipeline with an estimated capacity of 1mb/d and a total length of 1670 kilometres (km) would be instrumental in providing access to Central Asian and Russian crude oil even though it would have to transit through about 700 km of politically unstable territory in Afghanistan The total investment costs estimated for the construction and operation of the pipeline are estimated at $ 2 7 billion and $ 130 million/year (m/y), respectively The companies also intend to construct a terminal in Pakistan with port facilities to receive tankers of up to 300000 dead weight (dwt), with a storage capacity of 10 million barrel (mb) and two single point mooring systems The CAOP project is linked with a similar proposal for a gas pipeline that would transport gas from the Daulatebad gas field in south-west Turkmenistan to Pakistan At present the project has been delayed due to the geopolitical problems in Afghanistan and its future implementation would be largely dependent upon a long-term agreement with the Afghan government and a credible guarantee for the operational safety of the pipeline

### *11.2.2 Prospects for gas exports*

The total gas reserves in Turkmenistan are estimated at 2 7 tcm-4 4 tcm, constituting about 8% of the total gas reserves in the Former Soviet Union Even though, Turkmenistan has the world's largest proven gas reserves, its production declined to only 16 bcm in 1996/97, or 50% of its production in the preceding year and about 19% of it peak output in 1989 This was largely a result of the disputes over price and transit tariffs with Gazprom of Russia, thereby leading to inaccessibility to the markets in western Europe that it served through the Russian pipeline network The government of Turkmenistan and the foreign oil and gas companies operating in Turkmenistan are therefore now interested in capturing the gas markets in Pakistan and India

Though the gas market in Pakistan is not very large as yet, the share of gas which currently stands at 38% of the total primary energy supply is being viewed as the most dynamic, with the gas demand having increased from 8 1 bcm in 1985/86 to 18 2 bcm in 1995/96, representing an average annual growth of 8 4% Moreover, a 30%-40% increase in the transmission and distribution networks in Pakistan was implemented in the period 1993-96 At present, Pakistan is self-sufficient in natural gas, however with the demand projected to increase to 27bcm in 2000/01, 36 bcm in 2005 and 48bcm in 2010 and the production leveling at 27-29 bcm, a large potential for imports to the extent of 20bcm is being envisaged

In the case of India, even though natural gas accounts for only 5%-6% of the total primary energy supply, there exists a large potential for the increase in natural gas demand, especially in the power generation sector. With the demand estimated to increase to 103 bcm and the supply leveling at 24 bcm (Planning Commission,1997b) by the year 2009/10, a large quantum of imports would be necessitated either through pipelines from Central Asia or as LNG from the Persian Gulf

A study conducted by the World Bank has established that gas exports from Central Asia to Pakistan and India are economically feasible since the cost of piped gas from Central Asia to Pakistan is estimated at $ 60-$ 78/thousand cubic metres which is lower than the cost of fuel oil estimated at $ 201/thousand cubic metre, that it would replace. In the case of India, the cost of piped gas has been estimated at $ 81- $109 which is again lower than the cost of coal estimated at $ 120, which the gas would replace

In 1993 a memorandum of understanding was signed between the governments of Pakistan and Turkmenistan for the construction of a gas pipeline with a capacity of 20 bcm/y Gazprom of Russia and the Indian government were also invited to join the project keeping in mind the possibility of an extension of the gas pipeline to India The proposed pipeline which would extend over 1400 km beginning at Yashlar, a large Turkmen gas field with reserves of up to 800 bcm, was slated for development by Bridas of Argentina at an estimated cost of $ 3 billion. The pipeline was proposed to be routed through western Afghanistan to Baluchistan in west Pakistan, where it would link up with Pakistani gas trunk pipelines. However, in 1995, the project was discontinued due to protracted problems with Bridas over the company's investments in the oilfields in Turkmenistan

In October 1995, the Turkmen government signed an agreement with a consortium of Unocal of the US and the Delta Oil Company of Saudi Arabia to build and operate a 1300 km pipeline from the Daulatebad field in Turkmenistan to Multan in northern Pakistan The route of the proposed pipeline was largely similar to that planned by Bridas, however the construction costs were much lower at $ 1 9 billion with an additional investment of $ 600 million for a possible extension to India The main innovation proposed by the Unocal-Delta consortium was its proposal to take a delivery of 20 bcm of gas at the Turkmen-Afghan border and market it at its own risk. The consortium also proposed the construction of an oil pipeline along the same route and the construction and operation of gas-fired power plants in Pakistan. Subsequently in October 1997, the Turkmen government signed an agreement with Unocal, Delta and other parties including the Crescent Group of Pakistan and Russia's Gazprom, to form the Central Asia Gas Pipeline Consortium (CentGas). Subsequently, however, Unocal the leader of the consortium pulled out of the project. Recently, the governments of Pakistan and Turkmenistan and Afghanistan's Taliban have signed a joint declaration to reactivate the pipeline project and the countries have asked Centgas to find a new project leader to replace Unocal

As indicated earlier the implementation of pipeline projects routed through Afghanistan is constrained by the political instability and the lack of an internationally recognized government, which are important prerequisites for securing finance The Unocal-Delta consortium has therefore stated that it would need to wait for the situation in Afghanistan to stabilize before it could commence the project implementation A joint agreement between the governments of Pakistan and Turkmenistan with the Afghan Taliban for the transit of the pipeline may however signal the development of the project

Some of the other factors that may influence the implementation of projects for gas imports in Pakistan include the application of new technology in the fields already in operation thereby leading to a yield higher than the expected recovery rate Also, foreign investment in exploration and production may lead to the discovery of new gas fields, as large areas in Pakistan remains unexplored with a well density of only 0 42 wells per thousand square kilometers compared to an average of 6 20 for India and the OPEC Furthermore, with implementation of the gas price reform, the potential for efficiency improvements in gas utilization could be much larger than expected

In addition, it may not be economically feasible to construct a pipeline based on Pakistan's future gas demand alone and it would be therefore necessary to integrate the gas demand in India, in planning the pipeline This is especially relevant in the context of the recent gas discovery in the Sindh province in west Pakistan, which could greatly reduce future gas imports in Pakistan Moreover, the extension of the pipeline from Pakistan to India may be constrained by the political differences that exist between the two countries

## 11.3 Prospects for LNG imports from the Middle East

Demand forecasts for natural gas indicate that 20 mt/y of LNG imports would be required by the year 2010/11 in India alone At present, three import terminals have been planned on the west coast of

India in the state of Gujarat to facilitate LNG imports from the Middle East, to meet the growth in demand In addition the cost of LNG imports estimated at $ 4 0 per million British thermal unit (mmbtu) and $ 3 5/mmbtu from Qatar to Gujarat and from Oman to Gujarat, respectively, is much lower than the cost of importing LNG from Malaysia to Gujarat which is estimated at $ 6.8/mmbtu. Therefore due to geographical proximity LNG imports from the Middle East to the high growth west coast in India, have been established as more economical than imports from anywhere else in Asia and Australia (Brower D, 1999)

On the east coast of India imports from Asia, Australia and the Middle East are equally competitive, as illustrated by the 1900 megawatts (MW) power plant at Ennore in Tamil Nadu served by an LNG import terminal at Ennore, for which a host of companies including Petronas, Tenaga, Woodside and Petronet LNG have submitted tenders.

The government has formulated Petronet LNG a consortium of two state–owned oil and gas companies, ONGC and GAIL and the power utility NTPC, which is expected to emerge as the largest consumer for LNG Petronet LNG is expected to handle the LNG imports to India. The import duty for LNG was also reduced from 12% to 5% in March 1999, while that for other competing fuels such as coal remain unchanged, thereby encouraging LNG imports

In May 1998, British Gas International (BG) signed a memorandum of understanding with Yemen LNG, for supplying 2 65 mt/y of LNG to BG's receiving terminal in Pipavav, Gujarat, the shipments for which are scheduled to begin in 2003 In 1997, BG acquired Gujarat Gas, a local gas distribution company to anchor the demand for Yemen LNG's production.

There also exists a large potential for gas exports from Qatar, the world's largest gasfield with an estimated reserve of 7 trillion cubic metre (tcm). In September 1999, Rasgas, a consortium comprising of the state-owned Qatar General Petroleum Company, Mobil, and the Japanese companies Itochu, and Nissho Iwai was awarded a twenty-five year contract for the supply of 7.5 mt/y of LNG to Petronet LNG. The shipment is expected to begin in July 2003 As a part of the contract Rasgas is also committed to constructing the 5 mt/y and 2.5 mt/y import facilities at Dahej in Gujarat and Kochi in Kerala, respectively The government of Pakistan has also signed a memorandum of understanding with the United Arab Emirates Offsets Group (UOG) for the supply of 1.0 -1 5 billion cubic feet per day (bcf/d) of natural gas from the North gasfield in Qatar

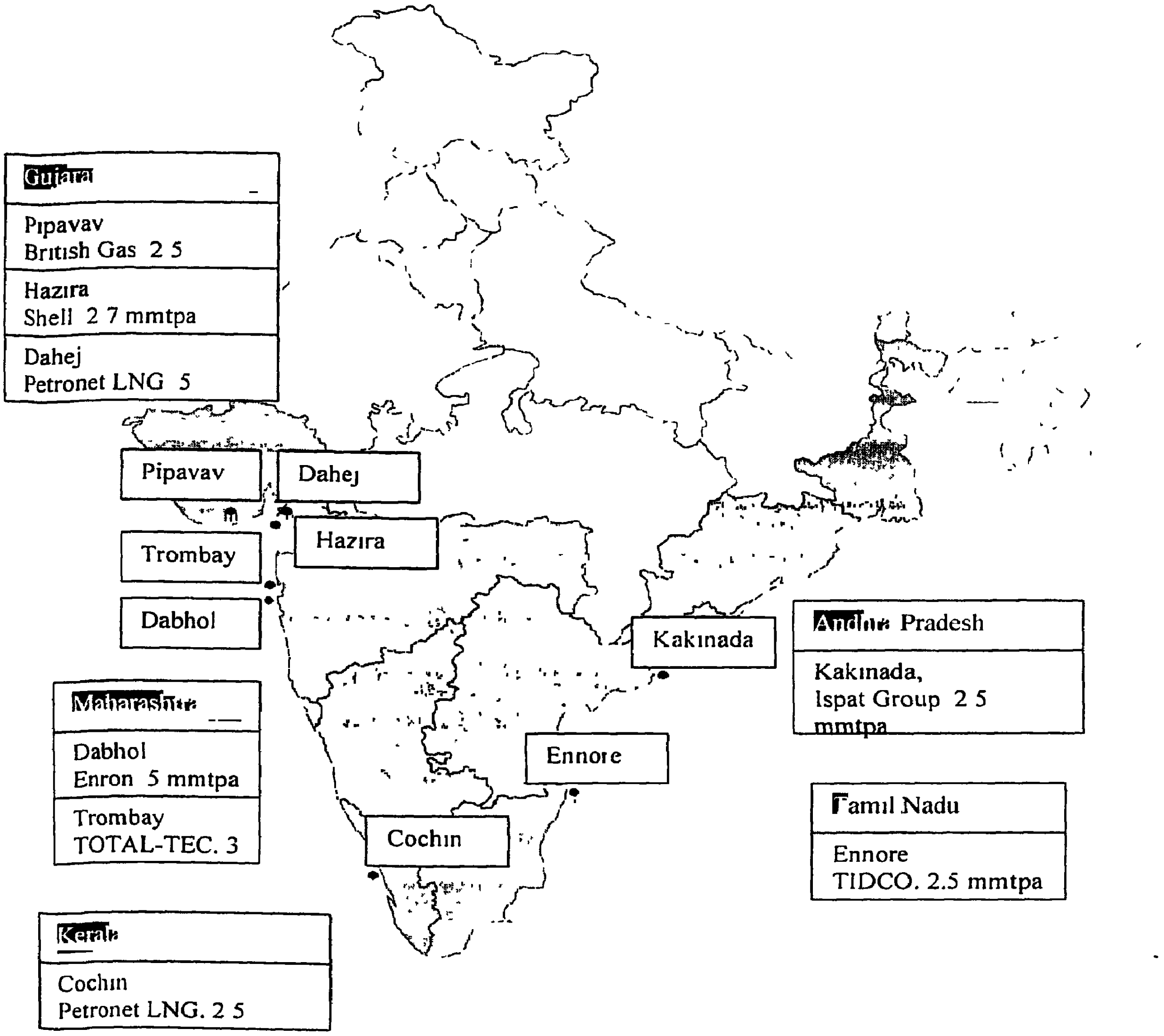
In August 1999, Oman LNG a consortium comprising of the government of Oman, Shell, Total, the Korea LNG consortium, Mitsubishi, Mitsui, Partex, and Itochu signed a twenty-year contract with Enron's Indian subsidiary Metgas for the supply of 1.2 mt/y of LNG to the import terminal planned to be constructed by Enron at Dabhol Enron's proposal to increase the supply of LNG to 1 6 mt/y, has been welcomed by Oman LNG which is keen to establish itself in the Indian supply chain, especially since the development of the sub-sea gas pipeline from Oman could not materialize due to technical constraints and a large share committed to buyers in Korea and Japan, thereby making the pipeline unviable The supply is expected to begin in the last quarter of 2001 and would be utilized primarily for Enron's 2450 MW power station at Dabhol in Maharashtra However, since the demand for LNG far exceeds the potential supply from Oman LNG, Enron has invited the Abu Dhabi LNG consortium to supply an additional 500,000 t/y of LNG on free on board (FOB) basis

More recently, Total Gas and Power India (TGPI), Tata Electric Company (TEC) and the GAIL have finalized a cooperative agreement to import LNG in Maharashtra Under the terms of the agreement Indigas a joint venture of TEC and TGPI will develop an LNG terminal with an initial capacity of 3 mt/y in the vicinity of Mumbai to facilitate LNG imports by the year 2003 While TEC will be utilizing the LNG for the power plant at Trombay, GAIL would be utilizing its share of LNG to meet the demand of the industry in the vicinity of Mumbai

Even though a large number of LNG projects are currently under planning and some projects are under implementation (Figure 11 1), some of the areas that need to be addressed, to establish a market for LNG are listed below

- The increase in demand for LNG, and a reduction in the freely available quantities because of long-term agreements between the consumers and producers, would necessitate adequate investments for augmenting current production capacities as well as expansion of existing import terminals, construction of new import facilities and transport infrastructure.
- The new pattern of demand would also imply difficulties in the contractual arrangements between the parties involved It is relatively easier to sign a contract with an existing power plant under expansion, as in the case of Oman LNG and Dabhol, however it may not be feasible for a producer to enter into an agreement with a power project that is yet to be built Integration of companies may be a part of the solution to make it more attractive for the producers to enter into a contract with the consumers, as in the case of RasGas which has entered into an agreement for the supplying 7 5 mt of LNG to Petronet LNG, with the possibility of a cross-shareholding between RasGas and Petronet LNG
- RasGas and Petronet LNG have also been involved in a dispute over transportation rights for the LNG that is scheduled to be supplied to the terminals at Dahej and Kochi. The dispute could also extend to the supply of LNG to Ennore

**Figure 11.1 LNG Imports in India**



## 11.4 Prospects of gas pipelines from the Middle East

While preliminary work has begun on a 1650 km pipeline from Qatar to Pakistan for the supply of 28-57 million cubic metre (mcm) of gas at an estimated cost $ 3 billion, there is significant potential for the development of a pipeline from Iran which an estimated gas reserve of 23 tcm and is the second largest gas reserve in the world

In 1995, Pakistan and Iran had signed a preliminary agreement to construct a pipeline from the South Pars gas field in Iran to Karachi in Pakistan with a probable extension to India. However, the project did not materialize due to technological and geopolitical constraints India and Iran have recently revived the proposal for the transportation of gas through a sub-sea pipeline avoiding passage through Pakistan's territorial waters A new proposal has also been developed for the supply of gas through a 1638 km pipeline from the Assaluya gas field in Iran to Gaddani in Balochistan The pipeline is estimated to cost $ 2 5 and would supply about a quarter of Pakistan's natural gas requirement

## 11.5 Prospects of a gas pipeline from Bangladesh

The current gas reserves in Bangladesh are estimated at 311bcm, though some foreign oil companies believe that the actual reserves may be much higher, thereby, allowing for significant gas exports from Bangladesh to India and Pakistan According to estimates even in the low oil price scenario, the export of 14 mcm/d or 100 bcm of gas over a period of twenty years, would generate an export earning of $ 450 million for Bangladesh, each year (TERI, 1998) In addition, to sustain the interest of foreign oil and gas companies operating in Bangladesh it would be necessary to examine the prospects for gas exports to India, as domestic consumption in Bangladesh alone would not be able to ensure a return on the large investment requirements

It has also been proposed that the gas produced in the north-eastern states of Tripura and Assam in India, could be transported by a Bangladeshi pipeline to the demand centres in India, for a given price. The government in Bangladesh has however ruled out the possibility of a gas pipeline from Bangladesh to India in the near future, due to an expected growth in the domestic demand for gas.

## 11.6 Acquiring acreage overseas

To meet the expected shortfall in domestic oil and gas supply, India has made efforts to acquire equity in Central Asia and the Middle East, thereby increasing the oil supply by about 22.5 mt/y by 2010/11 The countries that have been identified for acquiring acreage include Azerbaijan, Kazakhastan, Russia, Algeria and Iran ONGC Videsh Limited (OVL) in collaboration with BP Amoco and Statoil has also recently discovered two gas fields in Vietnam with estimated reserves of 58 bcm ONGC has also started drilling operations for gas in Bangladesh and plans to establish a seismic data processing centre

### *11.6.1 Central Asia*

The Central Asian region is rich in oil and gas resources, however, the economic upheaval caused by the disintegration of the Soviet Union, accompanied by the transition towards a market driven economy has created an inadequacy of funds for investing in infrastructure projects The total investment required for developing the oil and gas sectors is estimated at $ 200 billion (IEA, 1998)

The governments in the region are therefore looking for private investment, in particular from foreign companies to develop the oil and gas sectors Kazakhastan and Azerbaijan in particular have made considerable progress in attracting foreign investments by providing for appropriate legislation and through production sharing contracts, respectively An estimated investment of $ 600 million is required in Kazakhastan Recently, India has signed a trade agreement with Kazakhstan, which also provides for the possibility of the joint production and processing of oil and natural gas In this respect, ONGC, India has been granted rights to carry out exploratory work in Kazakhastan In Uzbekistan the government has favoured loan financed projects whereby foreign companies would perform services on a contractual basis, usually without holding equity Recently, Turkmenistan which has large gas resources has also adopted a policy to attract foreign investment

### *11.6.2 Middle East*

ONGC had been operating the Abu Khem oilfield in Iraq until the Gulf war in 1991 Recently an agreement has been signed with Iraq for the drilling of 100 wells in Southern Iraq including the Tuba oilfield that has an estimated reserve of 3 b, in return for crude oil. However the completion of the deal is subject to the lifting of the UN sanctions on Iraq

In addition, Indian Oil Corporation (IOC), is exploring opportunities for downstream operations including refining, transportation, marketing, research and development in the Middle East. It also plans to set up joint venture projects in the petrochemicals and power generation sectors

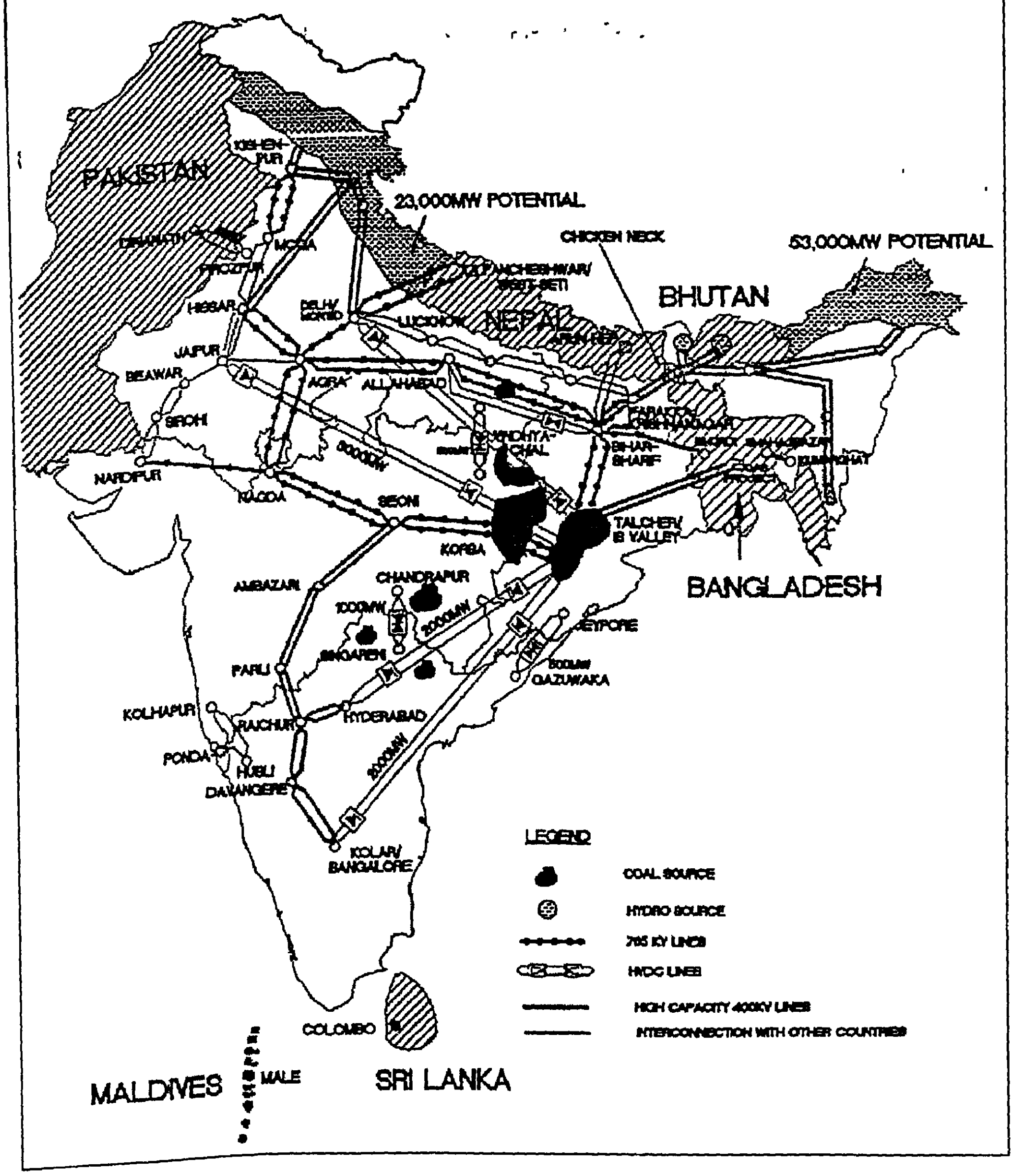
### *11.6.3 Venezuela*

India is also exploring the possibility of a joint venture with the government of Venezuela for the production and trade of oil and orimulsion, Venezuela's trademark fuel made from bitumen and water and used for power generation While the Indian government has expressed interest in investing in the oil exploration and extra-heavy oil upgrading sectors, the Venezuelan government has expressed a keen interest for exporting orimulsion, as it has been included on the list on fuels permitted for power generation in India Assistance has also been sought by the Indian government for the evaluation of heavy oil deposits that have been recently discovered in the state of Rajasthan

## 11.7 Power exchanges between the countries of the region

The imperatives for creating a South Asian power grid is necessary for ensuring optimum utilization of energy resources in the region and reliability of power supply, thereby boosting economy growth of the region There exists a large potential for hydro and gas based power generation as is evident from Table 11 3 Figure 11 2 provides the proposed SAARC power grid establishing inter-connectivity between the countries of the region

## PERSPECTIVE PLAN FOR MAJOR HIGHWAYS FOR NATIONAL AND SAARC GRIDS



Source Power Grid Corporation of India Limited, March 2000

**Table 11.3 Hydro and gas potential in South Asia**

| | Hydro potential (MW) | Gas reserves (bcf) |
|---|---|---|
| India | 84000 | 25000 |
| Nepal | 83000 | - |
| Pakistan | 36000 | 27000 |
| Bhutan | 21000 | - |
| Bangladesh | 52000 | 40000 |
| Myanmar | 37000 | |

Source Power Grid Corporation of India Limited, 2000

India has been importing hydro power from Bhutan and Nepal, to meet the power demand in the border areas In Bhutan the 336 MW Chukha hydroelectric project which has been implemented with Indian technical and financial assistance, is an excellent example of regional cooperation for sharing and development of resources About 1400 MkWh of surplus power from the project is being exported to India thereby generating an export earning of $ 50 million annually The 60 MW Kurichu and 1020 MW Tala hydroelectric projects are currently under implementation with Indian technical and financial assistance. Most of the power from the Tala project would be exported to India, the evacuation of which is being planned through 400 kilovolts (kV) transmission lines through the chicken neck area in eastern region in India. Other projects for which a Detailed Project Report has been prepared include the 900 MW Wangchu, 4060 MW Sankosh and 180 MW Bunakha hydroelectric projects India is also providing assistance for the development of eight mini/micro hydel project in Bhutan

India has also assisted Nepal for the implementation of the Pokhara, Trisuli, Western Gandak and Devighat hydroelectric projects At present, about 50 MW of power is being exported from Nepal through 132 kV and 133 kV transmission lines A 132 kV interconnection is also being planned between Tanakpur in India and Mahendranagar in Nepal. Currently the detailed project reports for five major projects including West Seti (750 MW), Arun (800 MW), Karnali (1080 MW), Pancheswar (5600 MW) and Saptakoshi (3300 MW) are under consideration. The evacuation of power to India from these projects is being envisaged through 765/400 kV transmission lines (MoP, 1998).

Keeping in mind the large potential for gas production in Bangladesh and the common boundary that Bangladesh shares on both its eastern and western borders with India, the prospects of power imports from Bangladesh are being actively considered. Even though some investments would be required for establishing an interconnection on both the western and eastern interfaces for importing about 150 MW of power in the initial stages, the benefits emerging would be manifold with an estimated pay-back period of 4-5 years.

In the case of Pakistan, technical feasibility has been established for the import of 300 MW of power to India through 220 kV transmission lines However, the price of power has been a contentious issue, thereby delaying the progress of the project. In February 1999, Pakistan signed a memorandum of understanding with Turkmenistan and Turkey for the interconnection of the power transmission systems of the three countries. As a part of the feasibility study, it is proposed to link Mari in Turkmenistan with Peshawar and Quetta in Pakistan with a 500 kV transmission line, with a capacity of 1000 MWh at an estimated cost of $ 290 million Pakistan is also exploring the possibility of power imports from Iran to some of the rural areas in Baluchistan, by the year 2001

## 11.8 Development of renewable energy technologies

The South Asian region is well endowed with renewable energy resources However, the exploitable potential depends upon the availability of resources, the status of technology, and the end-use pattern The application of RETs is also largely influenced by the degree of research and development that needs to focus on development and commercialization of technology. Widespread information dissemination and awareness campaigns also need to be launched with respect to RETs and their advantages over other technologies Finally, enhanced regional cooperation aimed at sharing technological expertise, promoting scientific research, and mobilizing financial resources could contribute immensely to the development of RETs

In the case of India it has been estimated that if all the RETs were to be successfully adopted, the annualized system energy cost would change from Rs 4114 billion to Rs 4019 billion In addition, $CO_2$ emissions would go down by 20% over the business-as-usual scenario and in the case of local pollutants, emission of suspended particulate matter would be reduced by 24%.

The heavy dependence on fuelwood and increasing deforestation in Nepal has serious implications for the forest cover and ecological balance in the adjoining areas in India as well There is therefore a significant potential for the commercialization of solar photovoltaic and biogas technologies both in the rural and industrial sectors, as also for the development of mini/micro hydel in the hilly regions with irrigation of agricultural lands arising as a spin-off benefit These technologies have remained largely under-developed due to lack of technological expertise, inadequate financial support, the absence of industrial applications for biogas technologies and the lack of an integrated approach.

In Bangladesh, biomass constitutes a large share of the energy supply in the rural sector, while the energy policy clearly advocates that biomass fuels be supplemented by commercial energy in order to help meet the demands in rural areas on a sustainable basis However, due to constraints on resources and infrastructure in supplying commercial energy to offshore and remote areas such as Beel and Haor, it is essential to develop renewable energy technologies, despite the high capital cost Remote and isolated areas, including the off-shore islands, areas, which are not likely to be brought under the networks of commercial fuels in foreseeable future are to be considered as potential sites for implementing renewable energy technologies, in spite of their high capital cost. The potential for RETs such as solar photovoltaics, solar thermal conversion, wind turbines, mini/micro hydel, tidal and wave energy also need to be assessed based on the economic and technological considerations Similarly in the case of Sri Lanka, the potential for hydropower has been exhausted and there exists a pressure on the forest resources to meet the energy requirements of the rural domestic sector There is therefore a significant potential for the development of firewood plantations

Most of the RETs that have been discussed in the preceding paragraphs could be developed by sharing of technological expertise and resources amongst the countries of the region The barriers pertaining to the development and implementation of RETs could be overcome through an integrated effort and strengthening of linkages with India which has acquired a fair degree of expertise in developing renewable energy technologies In this respect some of the recommendations include (TERI, 1998)

- Sharing of technological expertise
- Research and development
- Training programmes
- Resource mobilization, perhaps, through the formulation of a technical cooperation fund.

Therefore as is evident from the preceding paragraphs, there is a high cost attached to non-cooperation and though there exist political difficulties, a concerted effort is required for greater regional integration which cannot be restricted to South Asia and must extend to Asia as a whole.

## References

1. Brower D. 1999 *LNG Producers Scramble for Energy Markets.* Petroleum Economist. World Energy Yearbook. UK
2. IEA 1998. *Caspian oil and gas: the supply potential of Central Asia and Transcaucasia* Paris: International Energy Agency
3. MoP. 1998. *Annual Report* New Delhi: Ministry of Power, Government of India.
4. Petroleum Economist 1999. *The World Energy Yearbook* London, UK
5. TERI 1998 *Energy Security Issues and Implications for South Asia* New Delhi Tata Energy Research Institute

# Chapter 12: Conclusions and recommendations

Political stability and a strong institutional framework are important prerequisites for social and economic progress The lack of sound political governance has harmed the South Asian economies in the past, and it is therefore necessary to create in each nation a democracy based on strong institutions that function within a legal and regulatory framework, so as to reap the benefits of globalization

The impact of economic openness on economic vulnerability and volatility is an issue that has been under debate for a long time Economic and empirical evidence has clearly demonstrated that outward-oriented policies should constitute the central part of the development strategy, and the recent financial crisis in Asia does not change this rationale However, it does raise questions about the desirability of completely free capital movement and full capital account convertibility

Free and open trade and a secure framework for investments contribute to the development of efficient markets for assuring uninterrupted energy supplies that constitute the cornerstone of any industrializing regime In light of the increasing energy demand-supply mismatch, which points to a growing dependence on imports, energy security assumes great significance in the South Asian context

Energy infrastructure projects ranging from developing the primary fuel source, its transportation and conversion to useful energy services are usually complex in their investment requirements Given the enormous resource requirement in developing the energy and infrastructure sectors in the region, the governments need to evolve a policy towards greater private sector participation Efforts are also required to accelerate the pace of reform in the areas of public finance consolidation, and development of financial and capital markets, so as to achieve sustainable infrastructure development and hence, healthy economic growth

In light of the growing gap between energy demand and supply it has also become necessary to increase the role of domestic capital markets and international development finance. Most analysts, however are of the view that even though sufficient finance is available for the global energy sector requirements, there exists a problem in mobilizing finances for investments in developing countries, where 90% of the future energy demand is expected to occur.

In this respect, obstacles including the absence of an appropriate regulatory framework, lack of proper market-based instruments, poor coordination amongst the various government agencies in implementation of projects and unavailability of long-term funds need to be removed. Some of the initiatives that are required for ensuring a sustainable energy supply in the region are

## 12.1 Changes in governance

The development of energy infrastructure has so far been primarily in the public domain Privatization, or a decrease in public ownership, oriented towards a market-driven economy, has become a vital element of the trade and investment policy, particularly in the energy sector all over the world In part, the rationale for privatization stems from the growing conviction amongst countries that free enterprises advance the economy better than nationalized or planned economies For many countries, privatization has become the only effective mechanism for raising investment capital, reducing debt and generating revenue on favourable terms

Several variations in the mechanism for privatization have been adopted One example of an attempt at privatization is when a government divests itself of all state-owned enterprises and removes itself from the control and management of these enterprises At another extreme, the government may implement a policy for deregulation allowing the industry only marginal autonomy, and may privatize services on a contractual basis Efforts have also been made to introduce private financing of projects while maintaining the state monopoly in the central position These schemes however, have had limited success since the state-owned utilities remain the sole buyers, and the owners of the new capacity lack direct access to customers, thereby insisting upon the government underwriting the performance of the monopoly It is therefore necessary to reform and restructure the state-owned utilities so that they function on a commercial basis, thereby attracting private investments

## 12.2 Regulatory institutions

In most countries of the region, the government has undertaken the restructuring of energy enterprises prior to transfer for ownership It should be noted that privatization does not necessarily imply that the government should relinquish their authority to regulate However it needs to be emphasized that if private capital is to provide the basis for funding, the issue of ownership will need to be addressed, with the role of the state transforming from ownership to providing a regulatory role as guardian of public interest

Energy markets all over the world, are less regulated than they were some years ago and governments across South Asia are continuing to reform their role. A competitive climate will facilitate the expansion of opportunities to find innovative technology solutions, diffuse them more rapidly and encourage diverse and flexible responses to the energy requirements of the region, by mobilizing finance for the growth of the energy sector

Regulatory reform processes face numerous challenges as countries in the region adopt a change in their approach to infrastructure sector management In particular, private sector participation is being introduced in almost all areas, and the state's role in providing direct services is being reduced Also, a new style of governance is emerging in the enactment of regulatory reform to ensure an effective balance of interests amongst government, customers, and investors It is therefore important to facilitate effective and efficient regulation of utilities and energy industries, provide high quality capacity building and training on energy sector regulation, stimulate research, and create a network of regional and international institutes for sharing knowledge and expertise on the regulatory reform process

## 12.3 Knowledge creation and exchange

Sharing of information in the energy and environment sectors is a vital component in the success of energy-efficiency programmes for improving the state of the environment Also, since the member countries share common concerns, an information network would greatly facilitate the development of joint strategies that benefit all. With the information technology (IT) revolution, information networks are capable of providing cheap, reliable, efficient, and instant communication. Several examples of energy-environment information networks exist in the developed countries, however, in the context of South Asia, little work has been done so far.

A regional network of recognized institutes of excellence would facilitate research, information dissemination, technology transfer and contact with regional policy makers Harmonization of infrastructure development policies will lead to greater investor confidence, pooling of natural resources and technologies, and capacity building conducive to the prosperity of the people.

Moreover the process of liberalisation and economic reforms being pursued by several countries in the region provides a great scope for sharing experiences and adopting institutional measures on a uniform basis so that every country in the region can benefit from a fair, transparent and equitable investment policy. In this respect it is necessary to examine the resource potential and assess the investment requirements for individual countries propose a strategy for sharing resources and investment costs, developing a common approach for developing financial and capital markets, enhancing investor confidence, and evolving a regional financing mechanism

## 12.4 Technological development

Advancements must be sought to increase the service quality and benefit per unit of energy employed There exist significant opportunities for energy efficiency in the entire fuel cycle from the point of production to consumption Strong efforts are required by governments to recognise these opportunities and continue research and development through international co-operation in the development and dissemination of technologies Furthermore with a decline in the budgetary support in developing infrastructure for new technologies, significant investments are necessary from the private sector through innovative financing schemes

Fuel diversification is necessary to increase the flexibility of the overall energy system from energy sources to end-use devices Diversity, efficiency and flexibility within the energy sector are basic conditions for longer-term energy security, the fuels used within and across the sectors and the sources of those fuels should be as diverse as possible Increased use of renewables can play an important role in this respect, however the major impediment is the lack of access to technology at competitive prices Similar capital and infrastructure constraints apply to the use of clean coal and natural gas based technologies

Given the similarity in the fuel requirements and dependence on low-efficiency devices in the rural areas of the countries in South Asia, the development of an integrated rural energy system that promotes fuel switching, fuel saving and fuel augmentation, is vital for meeting the energy requirements in the villages In this respect, it is essential to develop a mechanism for effective demonstration of renewable energy technologies, provide capacity building at the local and institutional levels, and devise a means for financing of projects

## 12.5 Demand side management

Markets are an excellent foundation from which to encourage energy efficiency and demand restraint Some of the interventions in this respect include real cost pricing, removal of subsidies and cross-subsidies and using taxes and levies In most countries of the region energy prices, in particular for electricity, household cooking and transportation fuels still remain below the cost-recovery levels These distorted prices not only reduce the incentive to exercise demand restraint, they induce demand that would not occur if market principles were applied

It is therefore paramount that energy prices reflect the long term cost of supply and are not made artificially low Flexible pricing structures can be used to give clear signals for facilitating an optimal allocation of resources both on the supply and demand side Higher fuel prices would induce the development of fuel saving technologies as in the case of Japan and Europe. In the power sector, higher tariffs in peak demand periods will shift some demand to off-peak periods In addition, an accurate billing system is one of the important prerequisites for giving accurate price signals.

Decisions to invest in energy-efficient technologies require clear and accurate information on energy prices, investment requirements, product performance and potential savings. A prerequisite for information on equipment performance is data based on energy audits and testing of equipment Labels provide purchasers, information about equipment performance and energy consumption and are important in determining the life-cycle cost of appliances Energy labels also motivate the manufacturers to produce more efficient products. Standards and regulations related to energy efficiency are effective in establishing a minimum efficiency value and ban products that do not meet the stipulations. They also enable the consumer to distinguish between the energy consumption values of different models and hence make their choice judiciously Additionally, the advantage of national standards extends across countries to which these products are exported

Experience in countries such as Japan and Korea has shown that an effective way to address some of the information intermediation barriers and policy barriers to efficiency is to set-up a high level, independent efficiency institute This is particularly important in the context of developing countries where most supply enterprises resist taking up the responsibility of energy efficiency as it is conflicting with their objective of maximizing sales. These institutes could conduct energy audits, provide financial assistance, promote cogeneration, support R&D, promote renewable energy technologies, and undertake the task of creating public awareness on the imperatives for improving energy efficiency. The Energy Efficiency Centre in Japan and the Korean Energy Management Corporation offer a valuable model to the newly industrializing economies of the region.

Moreover, a successful energy efficiency strategy requires that policy priorities are clearly defined and that appropriate instruments and sufficient resources are deployed In particular there is a need for a coherent energy efficiency policy in the transport and industrial sectors Efforts to promote energy conservation in the energy intensive industries could lead to substantial reduction in the cost of production, making them globally competitive Policy action is also required for enhanced programme monitoring Expertise also needs to be strengthened in project design and evaluation, assessment of costs and benefits of energy efficiency programmes

## 12.6 Integration of energy markets

The imperatives for integrating energy markets in South Asia stem from the fact that there exists a significant variation in the resource availability and technological skills to harness these resources, within the region Also there exist large economic benefits in pooling of resources, thereby reducing the cost per unit of energy Even though, there exist several opportunities, which are both economically and technologically feasible, the development of projects and their implementation are dependent on the policy framework and political will of the countries in the region

Regional integration has been regarded as complementary to wider trade liberalization However, at present, the benefits of economic integration are elusive in the South Asian context Significant efforts are therefore required to increase intra-regional trade that accounts for as little as 4% of the total trade in South Asia Strategic considerations between India and Pakistan, and the threat of further integration with India in the case of smaller economies, are amongst the major factors that have hindered regional integration

# Annexure A

## A.1 Interview with Mr R.P Singh, CMD, Power Grid Corporation of India Limited

Q Could you tell us about POWERGRID's operations in India?

Ans Power Grid started its commercial operations in 1991, and is, therefore, a relatively young organisation As on date we are operating about 37,000 ckt kms of extra high voltage transmission lines with a voltage ranging from 132 kV to 800 kV, at an availability of more than 98% Power Grid is ranked amongst the top six utilities in the world About one third i e. over 30,000 MW of power generated in the country is being transmitted by Power Grid The entire nation has been divided into five regions and each has its own strong regional transmission system which is owned and maintained by Power Grid Power Grid is also in the process of establishing a National Grid, the first phase of which is near completion and about 3,500 MW power can be exchanged from one region to another in the country I think this is a good achievement The second phase of the National Grid is scheduled to be completed by 2004-2005, which will facilitate exchange of about 14,000 MW of power across the country The completion of the third phase by 2012 will facilitate an exchange of 30,000 MW of power As you are aware, India has a large coal potential in the east and the hydro potential is largely in the north and north-east, whereas the demand centres are located through out the country Hence, a strong transmission system is a must In this direction, we are planning a Transmission Highway to connect the East, West, North and North-Eastern regions by a 800 kV double circuit ring and the Southern region through HVDC links because of the long distance involved and also to minimise the Right-of-Way thereby preserving the nature This transmission system shall take care of evacuating power from Nepal, Bhutan and Bangladesh

Such a vast power system network needs modern Load Despatch and Communication facilities Power Grid has, therefore, undertaken the work of establishing such load centres with desired facilities in phased manner, which would be completed progressively from 2002 to 2005.

We also have plans to diversify into the Telecom Sector by installing over 42,000 Kms of optical fib cable and building an all-India high capacity communication network as the National Long Distance Operator.

Q: What are the investment requirements for creating this transmission ring, and what are the strategies for resource mobilization?

Ans The investment requirement for creating this ring is estimated at about US $ 12 to 15 billion The investments have already begun. However, this job will be done in phases and would be completed by end of the XIth plan The strategy for mobilizing resources will comprise of a combination of Power Grid's fund, multilateral funds, domestic borrowing as well as private investment through joint ventures (JV) and independent private transmission companies (IPTCs)

Q What has been the extent of private sector participation in the transmission sector?

Ans: Transmission has been recognised as a separate activity by the Electricity Supply (Amendment) Act, 1998, which also allows for private sector participation However, the main problem for private investors relates to the recovery of dues from SEBs Therefore, unless the SEBs become commercially viable, private investors are reluctant to come into this sector Therefore, in order to encourage private investment, Power Grid may initially take model transmission lines through JVs and IPTCs and assume the responsibility of collecting tariffs from SEBs Gradually, however, the private transmission companies will have to take the risk of tariff recovery from SEBs

Q The Government has proposed the creation of Rs 3,000 crore fund called the Accelerated Power Development Fund. What would this fund be utilized for?

Ans This fund has been created by the Government for developing the sub transmission and distribution system of the SEBs which needs significant improvement The fund would be made available to the SEBs that are restructured and wish to modernize their sub-transmission and distribution system and more importantly the metering system

Q: Do you think convergence of power transmission & distribution, telecommunication and internet service provision will facilitate the development of the power sector?

Ans. Yes, I am convinced that Convergence of the power Sector with telecom, multi media and infotech sectors will not only benefit the power Sector but also these sectors. In my view, convergence would optimise environmental impact, project costs and project time schedule for telecom projects due to the use of existing infrastructure The transmission and distribution assets of power utilities can offer Right-of-Way for rolling out optical fibre cables and a high capacity network to support various broad band services such as internet, video on demand, tele banking, tele education, tele medicine etc Therefore, inclusion of the power sector in the convergence process fits in perfectly and would ultimately result in bringing down the tariff to the consumer The phenomena of the convergence is already successful across the world. In USA alone over 80 energy companies have now converged with the telecom sector and own over 20% of the US fibre optic capacity.

From the investors angle also, convergence projects are preferable, as they spread risks over a number of commodities and ensure multiple revenue streams once the projects are completed.

Power Grid also has ambitious plans in this area and is developing an all fibre network of about 6000-7000 km covering various metros in the country in about 3 years time

Q What are the potential benefits in the development of a South Asian Power Grid?

Ans There are tremendous benefits in the pooling of resources in the South Asian region Nepal, for instance, has a very large hydro potential, while there will never be a commensurate load growth and the same holds true for Bhutan. Similarly, Bangladesh has large gas reserves which can be used for power generation Option for these countries is, therefore, to sell the surplus power to the neighbouring countries. India is paying Bhutan $40 million for the 336 MW of power which is being imported from the Chukha project. This amounts to roughly half the GDP in Bhutan. Bhutan's per capita GDP is higher than that in India as it has a population of only 1 million The Government of Bhutan is setting up another 1000 MW project for which the Indian Government is providing financial support by way of 60% grant and 40% loan. Therefore, I think there is great economic wisdom in sharing the natural resources in the region. Incidentally, South Asian Power Grid could also be developed for international communication purposes by laying optical fibres. This potential should also be tapped. Sri Lanka too has exhausted its power potentials, while the demand continues to grow leaving them with little choice but to import power from India neighbouring countries. While most countries are aware of the economic benefits of establishing inter-connectivity with India, they are wary of its dominant size in the region. While I do not envisage any problem for power exchange with Bhutan and Nepal, political considerations have always overshadowed economic benefits in negotiations with Pakistan, Bangladesh and Sri Lanka

## A.2 Interview with Mr B.C Bora, CMD, Oil and Natural Gas Corporation Limited

Q: Could you tell us about ONGC's operations in India?

Ans: ONGC as you are aware is an upstream oil company. Currently, about 85% of the oil and gas production in the country is accounted for by ONGC. Most of fields that we are currently operating are more than 20 years old and have reached a mature stage of exploitation. Over the last five years, we have not been able to add new reserves to replace what we produced, in other words, our reserve placement ratio has been less than one. This was mainly because the incremental discoveries in the mature basins where we are operating are diminishing as the larger discoveries have already been made Therefore, we have to find new oil in new places With that in mind, we have expanded our activities in recent years, particularly in the last year to the frontier basins, which were, either not explored very well or were not explored at all One area, which is of interest to us is the exploration of deep waters both on the west and east coast of India. We have upgraded one of our drilling vessels to drill upto 900 mtr water depth. We have made a small beginning by discovering some oil and gas at about 300 mts of water depth in Krishna Godavari last year. Now we are drilling a wild cat well on the Kerala coast in a new basin called the Kerala-Konkan Basin (water depth of 880 mts). This is the first deep water well being drilled in that area

Q What are your reactions to the NELP announced in 1999?

Ans As a result of the NELP, we have to now bid along with the private oil companies. At present we hold only about 10% of the total sedimentary basin area in India. Of the 26 sedimentary basins only 6 of them have proven recoverable oil and gas reserves. Some exploration has been carried out in the other basins but except a very small quantity of gas discovered in Rajasthan, no major discoveries have taken place so far Basically under the NELP, we will have to win blocks through competitive bidding But then since we have a comprehensive database for most of the basins in India and the infrastructure, including a large number of technically qualified manpower, we feel that we are fairly well poised to win exploration blocks and hopefully will continue to be a major player in India's oil and gas sector in the future.

Q: What are the factors that you would attribute to the luke warm response to the NELP?

Ans The NELP that was announced in 1998 included a few shallow water blocks and very few deep water blocks in East Coast, besides a few onshore blocks I would say that the deep-water blocks got a very good response, while the shallow water blocks got a fairly good participation It is true that in the perspective of international oil companies, India does not hold very high prospectivity as there have been no major discoveries in the last 15 years Also other countries, have opened up the E&P sectors for private sector participation around the same time. Since oil companies earmark a limited budget for exploration they would rather invest in those countries where the geological perspective is higher But I think the perspective would change once we make a large discovery in the frontier basins, particularly deep waters in the near future

Q There have also been some efforts to enhance production from the Bombay High offshore basin Could you tell us about the initiatives in this respect?

Ans Yes, infact the Bombay High oil field has produced nearly 20% of the oil in place already It is in mid-life and like any other oil field around the world has developed some mid-life problems We have gone though a very massive data acquisition programme on this field We have fine tuned the reservoir model and are in the process of conducting forecasting studies Hopefully we would be able to draw up a redevelopment plan by June-July 2000 We feel that we should be able to increase the recovery from this field from the earlier estimate of 26% to about 35%-40% through this redevelopment plan Parallely, we have embarked upon some lab scale studies on enhanced oil recovery In case the lab scale studies prove to be viable we shall make up a few pilot projects and should they also succeed we could plan on further investments, may be 3-4 years from now to improve the recovery factor beyond 35%-40%

Q What are the investment requirements for future exploration and production and what are the strategies for resource mobilization?

Ans Well as far as the redevelopment of the Bombay High offshore field is concerned, the order of investment would be around $1 billion, which would be funded from our internal resources We are also planning on expanding our operations outside India A number of proposals are being discussed, some of them nearing conclusion and hopefully by the middle of the year 2000 we will be able to finalise one or two projects Now these projects will also involve large investments Since our debt-equity ratio has been brought down substantially, we should be able to raise the requisite finance through the debt route. The exact quantum is difficult to assess now

Q What are the prospects for investments in the Middle East and Central Asia? Also what has been the progress in Vietnam?

Ans. In Vietnam we have a 45% equity in an offshore gas field The other partners are BP-AMOCO, Statoil of Norway and PetroVietnam, the local oil company We have discovered 2 trillion cubic feet of gas so far and we need to start production for which investments have to be made. We are in the process of finalising all the agreements with Vietnamese government for the purchase of gas and other guarantees within the next one or two months The development plan is ready and the development of the field will take about 2-2½ years and our expectation is that by 2002 we will start producing gas in Vietnam. The gas would be used in the power and fertilizer sectors. As regards the opportunities in other countries, we are looking at projects in Kazakhstan. Russia, Iraq and also in Iran The negotiations are progressing well and we hope that we should be able to sign a few contracts in the near future We have also been providing training on exploration and production to our counterparts in other countries for example in Vietnam, Kazakhastan and Iran.

Q. What is the status on the LNG project that ONGC is planning in Iran?

Ans It is still premature ONGC-IOC Consortium have received an offer from National Iranian Gas Company to take part in an LNG project in Iran with possible upstream linkage to bring LNG to India and other Asian markets as well. We have to examine the techno-commercial implications of the project jointly with IOC before we decide the exact nature of our involvement in the entire value chain.

Q What is the status on the ONGC and IOC alliance?

Ans This upstream-downstream alliance more applicable to out work outside India. There are, however, few opportunities within India where too we would work together. We are examining a few projects and should be able to reach an agreement in the near future.

Q· Which are the joint-venture projects with foreign oil companies?

Ans At present we have some joint venture projects for the discovered oil fields and exploration blocks created through the earlier rounds of bidding However, in the future, we shall be looking for joint-venture partners for exploration in the deep-water blocks where the key to success in case we make a discovery will be to produce the oil in the shortest time span and at the cheapest cost

Q What are your views on the pricing reforms in the oil and gas sector?

Ans I think this is a very welcome step taken by the Government to provide the national oil companies a level playing field Obviously the Government has a problem in passing the price increase to the consumer, and therefore the dismantling of the administered pricing mechanism will have to be in a phased manner. According to the present plans of the Government all the national oil companies will receive 100% import parity, by the year 2002 This should be fine

Q There has been some opposition to the governments' proposal for increasing the price for certain petroleum products Also the government decision's to roll back the subsidy on fertilizers was strongly opposed by the opposition parties What are your reactions?

Ans The Government is bound by certain political compulsions But, I think, if a decision is implemented, it sends a very good signal to the international community I am sure the Government realizes that and in the future there would be more inter-party discussions so that decisions are made through mutual consensus

Q Do you think the world is heading for another oil crisis with the oil prices increasing to $30/bbl and speculations of a further increase?

Ans It does raise concerns owing to the rising import bill for the consumer countries, like India Should the price remain high or tend to rise even beyond the present level, these countries will necessarily have to look at conservation and substitution with much more focus Taking this into consideration I am of the opinion that the oil exporting countries will surely see to it that prices come down to an acceptable level of $20-25 per barrel in not too distant a future

Q. What are the strategies that need to be developed proactively to safeguard against oil supply disruptions?

Ans Firstly, I think there is an urgent need to improve the efficiency of energy use This aspect assumes significance as we are large importers of energy and we will pay a heavy price if we do not improve the energy efficiency. In this respect, not only the Government but also the NGOs will play a vital role. Secondly, we have to explore the option of inviting the private sector companies to construct tankage for holding strategic stocks If we could create this infrastructure through private sector investment, the Government will not have to bear the cost of creating the infrastructure or holding the inventory At the same time the government can have an overriding provision, to buy the oil at the international price at the time of an oil supply disruption We also have to take initiatives to overcome the political barriers and find a way to get piped gas from gas rich neighbouring countries into India

Q What are the policy recommendations that you would like to make to ensure sustainable supply of oil and gas in India and in the region as a whole?

Ans I think most importantly, both the public and private sector companies need to be encouraged to look for equity oil outside the country, as has been done in Japan, S Korea, China and France, besides other countries Besides bringing in open acreage NELP bidding system within the country at the earliest, parallel efforts will have to be made to ensure that some of the frontier basins that have not been explored adequately are explored conclusively within the next 10-15 years For this purpose the Government will have to earmark certain funds, to encourage the oil companies including the national oil companies to undertake exploration in these basins. At the same time, it so happens that we are surrounded by countries that are rich in gas reserves like Iran, Qatar, Bangladesh, Myanmar, Turkmenistan Gas being an eco-friendly fuel, we have to work on a strategy to ensure that the gas is brought to India to take care of the energy requirements as well as environmental concerns

Q What are the factors that you would attribute to the gas pipeline from Bangladesh to India not materialising so far?

Ans In my opinion, since Bangladesh has very limited mineral resources, the general public opinion in Bangladesh is that the gas reserves could create a lot of opportunities in Bangladesh which would be lost if the gas was exported to India. I think we need to work with the government in Bangladesh and allay this fear by perhaps installing some power plants in Bangladesh and exporting power Alternatively some gas has been discovered in the state of Tripura, and though the quantity is not very large it could be transported through Bangladesh using a common highway So ultimately I think it is a win-win situation for both the countries.

## A.3 Interview with Mr Rajendra Singh, CMD, National Thermal Power Corporation, India

Q: What has been NTPC's role in the development of the power sector in India?

Ans· NTPC is a fore-runner in the Indian power sector, and has emerged as one of the largest power utilities in the world, thereby contributing to India's growth as a leading world economy The corporation accounts for 20% of the total installed capacity of the country but provides 25% of the total energy requirements Our mission is to make available reliable and quality power, by planning and implementing power projects and operating power stations economically and efficiently In this respect the corporation will seek opportunities for augmenting power generation through collaborative ventures in both the conventional and non-conventional energy sources The corporation will also contribute to the overall development of the power sector by sharing its expertise with other organizations and setting up projects abroad

Q· What is the generation capacity addition planned by NTPC and what are the strategies for resource mobilization in this context?

Ans By 2007 we plan to add 12,000 MW and by 2012 we will be adding another 10,000 MW We plan to have a total installed capacity of 30,000 MW by 2007 and 40,000 MW by 2012 We continue to explore opportunities for multilateral funding from agencies like the World Bank, and ADB for investment requirements In addition we are exploring opportunities for commercial borrowings Unlike the past power projects can now have a debt-equity ratio of 4 1. Accordingly NTPC is now using a debt-equity ratio of 7 3 for its projects The financing of the capacity addition programme has been drawn under the assumption that 95% of our dues from the SEBs and other consumers would be realized The total financial requirement is estimated at Rs 124881 crores, of which the requirement of internal resources will be Rs 37464 crores, which can be met only if 95% of the dues are realized I see no problems in raising the resources provided two basic pre-conditions are met. One is that we continue to get anticipated our payments from the SEBs are met. Secondly, I do not agree with Availability Based tariffs fixed by the CERC. As such we are selling the cheapest power in the country with the average selling price of Rs. 1.40/ kwh. The way the norms have been laid down by the CERC, I think they will have an adverse effect on resource mobilization If these norms are applied to the private sector I have serious doubts about their participation.

Q: What is the policy for joint venture projects?

Ans: There is considerable scope for capacity addition through joint-ventures However, while entering into an alliance NTPC will be cautious with regard to competence and credibility of the joint venture partners. We will also like to have a minimum equity stake of 26% to ensure NTPC's involvement in major decisions.

Q What are the factors contributing to the shortfall in the capacity addition programme for the IX th Plan period?

Ans There has been a slack on all fronts When the government announced the policy for private sector participation, everyone hoped that something magical would happen and there would a flow of investments in the power sector As result even the public sector efforts were given a go by For example we had seven plants in various stages of clearances which were given to the private sector

Q What are your views on the progress of power sector reforms?

Ans The impact of power sector reforms are yet to be demonstrated In Orissa for example the benefits from the reform process have been mitigated by the devastation caused by the cyclone In other states we are yet to see the real demonstrative effect of the reform process Other then that the availability tariff has totally devastated NTPC It is a very unpleasant experience that we are going through, we have filed a writ petition as well as petition in the High Court to seek redressal We believe that the tariff structure must encourage future investments both in the public and private sector to bridge the yawning gap between demand and supply

Q What are the projects that NTPC is planning in other countries of the region?

Ans We have been pursuing a power generation project in Bangladesh for a long time now But they want to know what the value addition in their country would be We said that project would meet your energy requirements first and the balance power would come to India, provided the price of the power is agreeable to the SEBs as well as the price of the gas We said that this project would be joint venture with the Bangladesh Power Development Board Negotiations have been going on but nothing has taken off the ground as yet

Q: What are the opportunities for establishing interconnectivity with other countries?
Ans· This is very fundamental to the development of the energy sector and we have been pursuing this for the last several years. There are several examples of interconnecting energy grids in the world, from America to Latin America, the Central Asian countries have Gasprom, there is also an interconnectivity between the European countries. I find no reason why this interconnectivity cannot be established in a resource rich region like ours

Q· What are the issues that need to be addressed for establishing inter-connectivity in the region?
Ans: There is the issue of political differences as well as differences in commercial interests I think if we could resolve the commercial issues, political issues would be taken care of

Q You are also the Member-Secretary for the World Energy Council. Could you tell us about the initiatives taken by the WEC and the agenda for the conference that is proposed to be held in New Delhi, in November 2000?

Ans The WEC has 11 Standing Committees and I am currently chairing a study on pricing of energy in developing countries We have also conducted a study on trans- border trading of energy in the South-Asian region The WEC has been emphasizing the development of renewable energy resources to meet the future energy requirements The conference in November will provide us an opportunity to revisit the concerns that have been discussed in earlier conferences in Tokyo and Houston I think it will be provide an opportunity for the countries of the world to work together towards resolving the problems of the energy sector

Q How does the corporate plan address environmental concerns?
Ans We are all aware of the environmental concerns in power generation. Associated with the vast opportunity for thermal capacity addition, there are certain environmental concerns that need to be dealt with Fuel diversification will be one such way. Based on the evaluation of the various options available the most desirable business areas are renovation and modernization of existing plants through separate joint ventures, investments in LNG re-gasification, investments in coal mining, ash-

based industries, setting up of pilot plants using renewable energy and setting up of hydel power plants.

But here again we need investments to meet the environmental stipulations.

Q: What are the prospects for the corporation in the global context?

Ans the productivity of our stations match the best national and international standards. The corporation plans to source capital, technology, equipment, fuels in a globally competitive manner, export surplus power from the eastern region in India to neighbouring countries, and step-up activities in consultancy, setting up of power plants, and renovation and modernization of existing power plants in third world countries either independently or through joint ventures

Q What are the policy directives for developing a sustainable power sector in India?

Ans I think the issue here is, how do you make energy available to everyone Secondly, how do you make the sector financially viable All policy directions must aim at making the sector financially viable, and therefore making sure that thefts do not take place, efficiencies are improved, and most importantly whatever power is generated is sold and the cost of what is sold is recovered

B.1 Power plant database (Existing plants Northern Region)- India

| Sl.No | Plant Name | State/Agency | Status | Special | Fuel Type | | | Benefits during Plan | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | comm MW | cand MW | 9th MW | 10th MW | 11th MW |
| | NORTHERN REGION | | | | | | | | | |
| 1 | Delhi TPS | DELHI | EXI | | COAL1D | 1131 5 | | | | |
| 2 | NCTPP | NTPCN | EXI | | COAL2W | 840 | | | | |
| 3 | Ropar+Bhatind | PUN | EXI | | COAL2W | 1700 | | | | |
| 4 | Bhatind-X | PUN | EXI | | COAL2W | 420 | | 420 | | |
| 5 | Suratgarh | RAJ | EXI | | COAL2W | 250 | | 250 | | |
| 6 | Sing+Rih+UNC | NTPCN | EXI | | COAL3E | 3420 | | | | |
| 7 | Obra TPS | UP | EXI | | COAL3E | 1482 | | | | |
| 8 | Anpara A&B | UP | EXI | | COAL3E | 1630 | | | | |
| 9 | Panipat+FBD | HAR | EXI | | COAL4F | 815 | | | | |
| 10 | Kota TPS | RAJ | EXI | | COAL4F | 850 | | | | |
| 11 | Pan+Par+Tanda | UP | EXI | | COAL4F | 824 | | | | |
| 12 | Tabda 4 | UP | EXI | | COAL4F | 110 | | 110 | | |
| 13 | Harduaganj | UP | EXI | | COAL4F | 515 | | | | |
| 14 | Unchahar-Exui | NTPCN | EXI | | COAL4F | 210 | | 210 | | |
| | | | | | COAL | 14197.5 | | 990 | | |
| 15 | Pampore-GT | J&K | EXI | | DIES7 | 175 | | | | |
| | | | | | DIESEL | 175 | | 0 | | |
| 16 | DVB CCGT | DELHI | EXI | | GASHBJ | 282 | | | | |
| 17 | Anta+Ram CCGT | NTPCN | EXI | | GASHBJ | 451 5 | | | | |
| 18 | Auriya CCGT | NTPCN | EXI | | GASHBJ | 652 | | | | |
| 19 | Dadri CCGT | NTPCN | EXI | | GASHBJ | 817 | | | | |
| | | | | | GASHBJ | 2202.5 | | 0 | | |
| 20 | Bhakra Comp | BBMB | EXI | | HYDRO | 2705 | | | | |
| 21 | WYC | HAR | EXI | | HYDRO | 48 | | | | |
| 22 | HP Hydro | HP | EXI | | HYDRO | 299 | | | | |
| 23 | JK HYD+SAL+URI | J&K | EXI | | HYDRO | 1354 | | | | |
| 24 | B SIUL+Chamber | NHPCN | EXI | | HYDRO | 720 | | | | |
| 25 | Tanakpur | NHPCN | EXI | | HYDRO | 94 | | | | |
| 26 | Pun Hydro | PUN | EXI | | HYDRO | 545 | | | | |
| 27 | Raj Hydro | RAJ | EXI | | HYDRO | 434 | | | | |
| 28 | RI+OB+MAT | UP | EXI | | HYDRO | 429 | | | | |
| 29 | Yamuna HEPS | UP | EXI | | HYDRO | 1063 | | | | |
| 30 | Sobla | UP | EXI | | HYDRO | 6 | | 6 | | |
| | | | | | HYDRO | 7697 | | 6 | | |
| 31 | RAPP | NPCN | EXI | • | NUCLEAR | 300 | | | | |
| 32 | NAPP | NPCN | EXI | | NUCLEAR | 440 | | | | |
| | | | | | NUCLEAR | 740 | | | | |
| | | | | | | 25012 | | 996 | | |
| | | | | | HYD+PSS | 7697 | | 6 | | |
| | | | | | COAL+LIG | 14197.5 | | 990 | | |
| | | | SUMMARY | | GAS+LNG | 2202.5 | | 0 | | |
| | | | | | LIQ FUEL | 175 | | 0 | | |
| | | | | | NUCLEAR | 740 | | 0 | | |
| | | | | | TOTAL | 25012 | | 996 | | |

### B.2 Power plant database (Existing plants Western Region)- India

| Sl No | Plant Name | State/Agency | Status | Special | Fuel Type | Installed Cap | | Benefits during Plan | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | comm MW | cand MW | 9th MW | 10th MW | 11th MW |
| | WESTERN REGION | | | | | | | | | |
| 1 | BSES | MHBSE | EXI | | COAL2W | 500 | | | | |
| 2 | TROMBAY TPS | MHTEC | EXI | | COAL3E | 1150 | | | | |
| 3 | VINDYACHAL | NTPCW | EXI | | COAL3E | 1260 | | | | |
| 4 | VINDYACHAL-2U1 | NTPCW | EXI | | COAL3E | 500 | | 500 | | |
| 5 | SABARMATI | GUAEC | EXI | | COAL4F | 410 | | | | |
| 3 | SIKKA TPS | GUJA | EXI | | COAL4F | 240 | | | | |
| 4 | DHUVRAN TPS | GUJA | EXI | | COAL4F | 534 | | | | |
| 5 | WKBORI+GNGR | GUJA | EXI | | COAL4F | 1920 | | | | |
| 6 | GNR5+WAN7 | GUJA | EXI | | COAL4F | 420 | | 420 | | |
| 7 | UKAI TPS | GUJA | EXI | | COAL4F | 850 | | | | |
| 8 | NASIK | MAHA | EXI | | COAL4F | 910 | | | | |
| 9 | PARLI-TPS | MAHA | EXI | | COAL4F | 690 | | | | |
| 10 | CHANDRPUR TPS | MAHA | EXI | | COAL4F | 1840 | | | | |
| 11 | CHANDRPUR U7 | MAHA | EXI | | COAL4F | 500 | | 500 | | |
| 12 | BHUSAWAL+PARS | MAHA | EXI | | COAL4F | 536 | | | | |
| 13 | KORDI+KHKDA | MAHA | EXI | | COAL4F | 1500 | | | | |
| 14 | KORBA E&W | MP | EXI | | COAL4F | 1530 | | | | |
| 15 | BIRSINGPUR | MP | EXI | | COAL4F | 420 | | | | |
| 16 | BIRSINGPUR-EX | MP | EXI | | COAL4F | 210 | | 210 | | |
| 17 | SATPURA | MP | EXI | | COAL4F | 1142.5 | | | | |
| 18 | KORBA E&W | NTPCW | EXI | | COAL4F | 2100 | | | | |
| | | | | | **COAL** | **19162.5** | | **1630** | | |
| 19 | PYGUTHAN | GUIPP | EXI | | GASHBJ | 655 | | 655 | | |
| 20 | UTRAN+GIPCL | GUJA | EXI | | GASHBJ | 482 | | | | |
| 21 | URAN GT | MAHA | EXI | | GASHBJ | 912 | | | | |
| 22 | TROMBAY | MHTEC | EXI | | GASHBJ | 180 | | | | |
| 23 | KAWAS+GAND | NTPCW | EXI | | GASHBJ | 1292 | | | | |
| | | | | | **GASHBJ** | **3521** | | **655** | | |
| 24 | KUTCH LIG | GUJA | EXI | | G-LING | 140 | | | | |
| 25 | KUTCH LIG3 | GUJA | EXI | | G-LING | 75 | | 75 | | |
| | | | | | **G-LING** | **215** | | **75** | | |
| 26 | UKAI | GUJA | EXI | | HYDRO | 307 | | | | |
| 27 | VAIT+BANDER | MAHA | EXI | | HYDRO | 104 | | | | |
| 28 | BHIRA+GAT+SUR | MAHA | EXI | | HYDRO | 102 | | | | |
| 29 | KOYANAI-3 | MAHA | EXI | | HYDRO | 920 | | | | |
| 30 | PAIT+TIL+6+ | MAHA | EXI | | HYDRO | 169 | | | | |
| 31 | PENCH HEP | MAHA | EXI | | HYDRO | 160 | | | | |
| 32 | KHOP-BHIRA | MHTEC | EXI | | HYDRO | 276 | | | | |
| 33 | BANSAGAR+ | MP | EXI | | HYDRO | 425 | | | | |
| 34 | HASDEO | MP | EXI | | HYDRO | 120 | | | | |
| 35 | G SAGAR | MP | EXI | | HYDRO | 115 | | | | |
| 36 | KOYANA IV | MAHA | EXI | | HYDRO | 250 | | 250 | | |
| 37 | WARNA | MAHA | EXI | | HYDRO | 16 | | 16 | | |
| | | | | | **HYDRO** | **2964** | | **266** | | |
| 36 | DABHOL-1 | MHIPP | EXI | | LNG | 740 | | 740 | | |
| | | | | | **LNG** | **740** | | **740** | | |
| 37 | GIPCL-EXT CCGT | GUIPP | EXI | | NAPH6 | 167 | | 167 | | |
| 38 | HAZIRA CCGT | GUIPP | EXI | | NAPH6 | 515 | | 515 | | |
| | | | | | NAPH6 | **682** | | **682** | | |
| 39 | KAPPI-2 | NPCW | EXI | | NUCLEAR | 440 | | | | |
| 40 | TAPP | NPCW | EXI | | NUCLEAR | 320 | | | | |
| | | | | | **NUCLEAR** | **760** | | | | |
| 41 | KADANA1-3 | GUJA | EXI | | PSTOR | 180 | | | | |
| 42 | KADANA4 | GUJA | EXI | | PSTOR | 60 | | 60 | | |
| 43 | BHIRA PSS | MHTEC | EXI | | PSTOR | 150 | | | | |
| | | | | | **PSTOR** | **390** | | **60** | | |
| | | | | | | **28434.5** | | **4108** | **0** | **0** |

| | | | | | |
|---|---|---|---|---|---|
| | **HYD+PSS** | **3354** | **326** | **0** | **0** |
| | **COAL+LIG** | **19377.5** | **1705** | **0** | **0** |
| **SUMMARY** | **GAS+LNG** | **4261** | **1395** | **0** | **0** |
| | **LIQ.FUEL** | **682** | **682** | **0** | **0** |
| | **NUCLEAR** | **760** | **0** | **0** | **0** |
| | **TOTAL** | **28434.5** | **4108** | **0** | **0** |

B.3 **Power plant database(Existing plants Southern Region)- India**

| Sl No | Plant Name | State/Agency | Status | Special | Fuel Type | Installed Cap comm MW | cand. MW | Benefits during Plan 9th MW | 10th MW | 11th MW |
|---|---|---|---|---|---|---|---|---|---|---|
| | SOUTHERN REGION | | | | | | | | | |
| 1 | RAMAGUN AP | AP | EXI | | COAL3E | 62 5 | | | | |
| 2 | KGDEM+4+NELL | AP | EXI | | COAL3E | 950 | | | | |
| 3 | KGDEM ST4 | AP | EXI | | COAL3E | 250 | 250 | | | |
| 4 | RAYALSEMA-I | AP | EXI | | COAL3E | 420 | | | | |
| 5 | VIJAYWADA TPS | AP | EXI | | COAL3E | 1260 | | | | |
| 6 | RAICHUR TPS | KAR | EXI | | COAL3E | 840 | | | | |
| 7 | RAMGUN STPS | NTPCS | EXI | | COAL3E | 2100 | | | | |
| 8 | N MAD+ENNORE | TN | EXI | | COAL9T | 1080 | | | | |
| 9 | TUTICORIN TPS | TN | EXI | | COAL9T | 1050 | | | | |
| 10 | METTUR TPS | TN | EXI | | COAL9T | 840 | | | | |
| | | | | | **COAL** | **8852.5** | **250** | | | |
| 11 | BANGL DG | KAR | EXI | | DIES7 | 128 | | | | |
| 12 | BRAMPURAM | KER | EXI | | DIES7 | 100 | 100 | | | |
| 13 | BASIN BRIDGE | TN | EXI | | DIES7 | 120 | | | | |
| 14 | BASIN BR | TNIPP | EXI | | DIES7 | 200 | 200 | | | |
| | | | | | **DIESEL** | **548** | **300** | | | |
| 15 | VIJJASERAM | AP | EXI | | GASHBJ | 99 | | | | |
| 16 | VIJJASERAM GT | AP | EXI | | GASHBJ | 59 8 | 59 8 | | | |
| 17 | JEGURU+GOD | APIPP | EXI | | GASHBJ | 252 | | | | |
| 18 | JEGURU+ Godavari | APIPP | EXI | | GASHBJ | 424 | 424 | | | |
| 19 | KARAIKALCC | PON | EXI | | GASHBJ | 22 9 | 22 9 | | | |
| 20 | NERIMANAN | TN | EXI | | GASHBJ | 10 | | | | |
| | | | | | **GASHBJ** | **867.7** | 506 7 | | | |
| 21 | POCHM+NIX+PEN | AP | EXI | | HYDRO | 64 | | | | |
| 22 | N SGR&TL+SSLM | AP | EXI | | HYDRO | 1739 | | | | |
| 23 | L SIL+DON+USIL | AP | EXI | | HYDRO | 725 | | | | |
| 24 | JOG+SHAR+LIN7 | KAR | EXI | | HYDRO | 2280 | | | | |
| 25 | KALINADI-II | KAR | EXI | | HYDRO | 230 | 230 | | | |
| 26 | MUN+SH+MA+TB6 | KAR | EXI | | HYDRO | 152 | | | | |
| 27 | KER HYDRO | KER | EXI | | HYDRO | 1477 | | | | |
| 28 | L PERIYAR | KER | EXI | | HYDRO | 120 | 120 | | | |
| 29 | KUTTI+MANIAR | KER | EXI | | HYDRO | 87 | | | | |
| 30 | ALI+SAK+SHL+MET | TN | EXI | | HYDRO | 558 | | | | |
| 31 | TN HYDRO SATHNUR+L | TN | EXI | | HYDRO | 992 | | | | |
| 32 | BHAVANI | TN | EXI | | HYDRO | 15 5 | 15 5 | | | |
| 33 | BHADRA RBC | KAR | EXI | | HYDRO | 6 | 6 | | | |
| | | | | | **HYDRO** | **8445.5** | **371.5** | | | |
| 33 | KAYAMKULAM | NTPCS | EXI | | NAPH6 | 350 | 350 | | | |
| 34 | NEYVELI 1&2 | TNNLC | EXI | | N-LIGN | 2070 | | | | |
| 35 | KALPAKAM | NPCS | EXI | | NUCLEAR | 340 | | | | |
| 36 | KADAMPARAI | TN | EXI | | PSTOR | 400 | | | | |
| | | | | | | **21873.7** | **1778.2** | | | |

| | Fuel | comm MW | cand. MW | 9th MW | 10th MW |
|---|---|---|---|---|---|
| SUMMARY | HYP+PSS | 8845 5 | 371 5 | 0 | 0 |
| | COAL+LIG | 10922 5 | 250 | 0 | 0 |
| | GAS+LNG | 867 7 | 506 7 | 0 | 0 |
| | LIQ FUEL | 898 | 650 | 0 | 0 |
| | NUCLEAR | 340 | 0 | 0 | 0 |
| | TOTAL | 21873 7 | 1778 2 | 0 | 0 |

B.4 **Power plant database (Existing plants Eastern and North-eastern region)- India**

| Sl No | Plant Name | State/Agency | Status | Special | Fuel Type | Installed. Cap<br>comm MW | cand MW | Benefits dunng Plan<br>9th MW | 10th MW | 11th MW |
|---|---|---|---|---|---|---|---|---|---|---|
| | EASTERN+N EASTERN REGION | | | | | | | | | |
| 1 | MUZFP+PAT+BR | BIH | EXI | | COAL1D | 536 | | | | |
| 2 | PATRA+TENU | BIH | EXI | | COAL1D | 1190 | | | | |
| 3 | DVC THERMAL | DVC | EXI | | COAL1D | 2310 | | | | |
| 4 | KOLAGHAT-TPS | WB | EXI | | COAL1D | 1260 | | | | |
| 5 | SANTALDIH TPS | WB | EXI | | COAL1D | 480 | | | | |
| 6 | BANDEL TPS | WB | EXI | | COAL1D | 530 | | | | |
| 7 | CESC+DISGARH | WCESC | EXI | | COAL1D | 695 | | | | |
| 8 | D P L TPS | WDPL | EXI | | COAL1D | 390 | | | | |
| 9 | BONGAIGAON | ASS | EXI | | COAL3E | 240 | | | | |
| 10 | MEZIA | DVC | EXI | | COAL3E | 210 | | 210 | | |
| 11 | BUDGE-BUDGE | WCESC | EXI | | COAL3E | 500 | | 500 | | |
| 12 | KAHALGON STPS | NTPCE | EXI | | COAL4F | 840 | | | | |
| 13 | TALCHER TPS | NTPCE | EXI | | COAL4F | 1460 | | | | |
| 14 | FARAKKA STPS | NTPCE | EXI | | COAL4F | 1600 | | | | |
| 15 | IB-TPSI | ORS | EXI | | COAL4F | 420 | | | | |
| | | | | | **COAL** | **12661** | | **710** | | |
| 16 | ARUNACHAL DG | ARUN | EXI | | DIES7 | 20 | | | | |
| 17 | NAMRUP+CHP | ASS | EXI | | DIES7 | 90 | | | | |
| 18 | MAITHONG GT | DVC | EXI | | DIES7 | 83 | | | | |
| 19 | MANIPUR DG | MANI | EXI | | DIES7 | 9 | | | | |
| 20 | MIZORAM DG | MIZO | EXI | | DIES7 | 16 5 | | | | |
| 21 | WBENGAL GT | WB | EXI | | DIES7 | 100 | | | | |
| | | | | | **DIESEL** | **318 5** | | **0** | | |
| 22 | ASSAM GAS PVT | ASIPP | EXI | | GASNER | 24 5 | | 24 5 | | |
| 23 | ASSAM GAS PVT | ASS | EXI | | GASNER | 443 5 | | | | |
| 24 | ASSAM GAS2 | NEEP | EXI | | GASNER | 90 | | 90 | | |
| 25 | TRIPURA GT | TRIP | EXI | | GASNER | 59 | | | | |
| 26 | ROKHIA+AGATALA | TRIP+neep | EXI | | GASNER | 92 | | 92 | | |
| | | | | | **GASNER** | **709** | | **206.5** | | |
| 27 | ARUNACHAL HY | ARUN | EXI | | HYDRO | 24 | | | | |
| 28 | BIHAR HYDRO-5 | BIH | EXI | | HYDRO | 169 | | | | |
| 29 | MITHON+PA+TIL | DVC | EXI | | HYDRO | 144 | | | | |
| 30 | MEGHALYA HYD | MEGH | EXI | | HYDRO | 235 | | | | |
| 31 | NAGALAND HYD | NAGA | EXI | | HYDRO | 5 | | | | |
| 32 | KOPILI | NEC | EXI | | HYDRO | 202 | | | | |
| 33 | LOKTAK+SMALL | NHPCE | EXI | | HYDRO | 107 | | | | |
| 34 | RENGALI HEP | ORS | EXI | | HYDRO | 250 | | | | |
| 35 | UKOL+BAL+MCH | ORS | EXI | | HYDRO | 800 | | | | |
| 36 | HIRAKUND HEP | ORS | EXI | | HYDRO | 308 | | | | |
| 37 | L LGYAP+SMSIK | SIK | EXI | | HYDRO | 35 | | | | |
| 38 | TRIPURA HYD | TRIP | EXI | | HYDRO | 16 | | | | |
| 39 | NURANG | ARUN | EXI | | HYDRO | 6 | | 6 | | |
| 40 | East Gandak Canal | BIH | EXI | | HYDRO | 5 | | 5 | | |
| 41 | RAM +JAL+SMA | WB | EXI | | HYDRO | 96 | | | | |
| | | | | | **HYDRO** | **2402** | | **11** | | |
| | Sub-total-ER+NER | | | | | 16090 5 | | 927 5 | | |
| | | | | | HYD+PSS | 2402 | | 11 | 0 | 0 |
| | | | | | COAL+LIG | 12661 | | 710 | 0 | 0 |
| | | | | | GAS+LNG | 709 | | 206 5 | 0 | 0 |
| | SUMMARY | | | | LIQ FUEL | 318 5 | | 0 | 0 | 0 |
| | | | | | NUCLEAR | 0 | | 0 | 0 | 0 |
| | | | | | TOTAL | 16090 5 | | 927 5 | 0 | 0 |
| | TOTAL-ALL-INDIA | | | | | 91410 7 | | 7809 7 | 0 | 0 |
| | | | | | HYD+PSS | 22298 5 | | 714 5 | 0 | 0 |
| | | | | | COAL+LIG | 57158 5 | | 3655 | 0 | 0 |
| | | | | | GAS+LNG | 8040 2 | | 2108 2 | 0 | 0 |
| | SUMMARY | | | | LIQ FUEL | 2073 5 | | 1332 | 0 | 0 |
| | | | | | NUCLEAR | 1840 | | 0 | 0 | 0 |
| | | | | | TOTAL | 91410 7 | | 7809 7 | 0 | 0 |

B.5 Power plant database (SOG schemes Northern Region)- India

| Sl No | Plant Name | State/Agency | Status | Special | Fuel Type | Installed cap comm MW | cand. MW | Benefits during plan 9th MW | 10th MW | 11th MW |
|---|---|---|---|---|---|---|---|---|---|---|
| | NORTHERN REGION | | | | | | | | | |
| 1 | PANIPAT-6 | HAR | SOG | | COAL2W | 210 | | 210 | | |
| 2 | SURATGARH | RAJ | SOG | | COAL2W | 250 | | 250 | | |
| 3 | UNCHAHAR-EXU2 | NTPCN | SOG | | COAL4F | 210 | | 210 | | |
| | | | | | **COAL** | **670** | | **670** | | |
| 4 | FARIDABAD | NTPCN | SOG | | GASHBJ | 430 | | 430 | | |
| | | | | | **GASHBJ** | **430** | | **430** | | |
| 5 | DADU+WYC2 | HAR | SOG | | HYDRO | 22 | | | 22 | |
| 6 | GHANVI | HP | SOG | | HYDRO | 22 5 | | 22 5 | | |
| 7 | LARGI | HP | SOG | | HYDRO | 126 | | | 126 | |
| 8 | SEWA+CHENANI | J&K | SOG | | HYDRO | 16 5 | | 16 5 | | |
| 9 | PARNAI | J&K | SOG | | HYDRO | 37 5 | | | 37 5 | |
| 10 | KISHAN GANGA | J&K | SOG | | HYDRO | 330 | | | 330 | |
| 11 | DHAULI GANGA | NHPCN | SOG | | HYDRO | 280 | | | 280 | |
| 12 | DULHASTI | NHPCN | SOG | | HYDRO | 390 | | | 390 | |
| 13 | Pahalgam+U Sindh | J&K | SOG | | HYDRO | 108 | | 108 | | |
| 14 | N JHAKRI | NJPC | SOG | | HYDRO | 1500 | | | 1500 | |
| 15 | THIEN DAM | PUN | SOG | | HYDRO | 600 | | 600 | | |
| 16 | SP KANDI | PUN | SOG | | HYDRO | 168 | | | 168 | |
| 17 | JAKHAM | RAJ | SOG | | HYDRO | 5 | | | 5 | |
| 18 | TEHRI-I | THDC | SOG | | HYDRO | 1000 | | 250 | 750 | |
| 19 | RAJGHAT | UP | SOG | | HYDRO | 45 | | 45 | | |
| 20 | Katapathar | UP | SOG | | HYDRO | 19 | | | 19 | |
| 21 | MANER+L VASI | UP | SOG | | HYDRO | 724 | | | 724 | |
| | | | | | **HYDRO** | **5393.5** | | **1042** | **4351.5** | |
| 22 | Haryana small | HAR | SOG | | DIES7 | 25 | | 25 | | |
| | | | | | **DIESEL** | **25** | | **25** | | |
| 23 | RAPP EXT | NPCN | SOG | | NUCLEAR | 440 | | 440 | | |
| | | | | | **NUCLEAR** | **440** | | **440** | | |
| | **Sub-Total-NR** | | | | | **6959** | | **2607** | **4352** | |

B.6 **Power plant database(SOG schemes Western Region)- India**

| Sl No | Plant Name | State/Agency | Status | Special | Fuel Type | Installed cap comm MW | cand MW | Benefits during plan 9th MW | 10th MW | 11th MW |
|---|---|---|---|---|---|---|---|---|---|---|
| | WESTERN REGION | | | | | | | | | |
| 1 | VINDHYACHAL2U2 | NTPCW | SOG | | COAL3E | 500 | | 500 | | |
| 2 | BIRSINGPUR-E X | MP | SOG | | COAL4F | 210 | | 210 | | |
| 3 | KHAPERKHDA 3&4 | MAHA | SOG | | COAL4F | 420 | | 420 | | |
| | | | | | COAL | 1130 | | 1130 | | |
| 4 | KOYANA IV | MAHA | SOG | | HYDRO | 750 | | 750 | | |
| 5 | DHUDHGANGA | MAHA | SOG | | HYDRO | 24 | | 24 | | |
| 6 | BANSAGR TONS | MP | SOG | | HYDRO | 110 | | | 110 | |
| 7 | N SAGAR | NCA | SOG | | HYDRO | 1000 | | | 1000 | |
| 8 | SAR SAROVAR-1 | SSNNL | SOG | | HYDRO | 650 | | | 650 | |
| 9 | SAR SAROVAR-2 | SSNNL | SOG | | HYDRO | 800 | | | 800 | |
| | | | | | HYDRO | 3334 | | 774 | 2560 | 0 |
| 10 | TARAPUR 3&4 | NPCW | SOG | | NUCLEAR | 1000 | | 1000 | | |
| | | | | | NUCLEAR | 1000 | | 1000 | | |
| 11 | GHATGHAR | MAHA | SOG | | PSTOR | 250 | | | 250 | |
| | | | | | PSTOR | 250 | | 0 | 250 | 0 |
| | | | | | | 5714 | | 2904 | 2810 | 0 |
| | | | | | HYD+PSS | 3584 | | 774 | 2810 | 0 |
| | SUMMARY | | | | COAL+LIG | 1130 | | 1130 | 0 | 0 |
| | | | | | GAS+LNG | 0 | | 0 | 0 | 0 |
| | | | | | LIQ FUEL | 0 | | 0 | 0 | 0 |
| | | | | | NUCLEAR | 1000 | | 1000 | 0 | 0 |
| | | | | | TOTAL | 5714 | | 2904 | 2810 | 0 |

**B.7 Power plant database(SOG schemes Southern Region)**

| Sl No | Plant Name | State/Agency | Status | Special | Fuel Type | Installed cap comm MW | cand MW | Benefits during plan 9th MW | 10th MW | 11th MW |
|---|---|---|---|---|---|---|---|---|---|---|
| | SOUTHERN REGION | | | | | | | | | |
| 1 | RAYALSEMA-III | AP | SOG | | COAL4F | 420 | | | 420 | |
| 2 | SIMADHARI U1 | NTPCS | SOG | | COAL9T | 500 | | 500 | | |
| 3 | SIMADHARI U2 | NTPCS | SOG | | COAL9T | 500 | | | 500 | |
| | | | | | **COAL** | **1420** | | **500** | **920** | |
| 4 | KOZHIKODE | KER | SOG | | DIES7 | 128 | | 128 | | |
| 5 | BASIN BRIDGESOG | TN | SOG | | DIES7 | 30 | | 30 | | |
| 6 | KARNATAKA Small | KAR | SOG | | DIES7 | 525 | | 525 | | |
| 7 | T N Small | TN | SOG | | DIES7 | 171 | | 171 | | |
| | | | | | **DIES** | **854** | | **854** | **0** | |
| 8 | KARAIKALCC | PON | SOG | | GASHBJ | 9 6 | | 9 6 | | |
| | | | | | **GASHBJ** | **9 6** | | **9.6** | **0** | |
| 9 | BALIMELA DPH | AP | SOG | | HYDRO | 60 | | | 60 | |
| 10 | SINGUR | AP | SOG | | HYDRO | 15 | | 15 | | |
| 11 | SHARV-TR | KAR | SOG | | HYDRO | 292 | | 292 | | |
| 12 | KAKKAD | KER | SOG | | HYDRO | 50 | | 50 | | |
| 13 | KUTTIYADI+2 | KER | SOG | | HYDRO | 76 | | 66 | 10 | |
| 14 | PYKARA | TN | SOG | | HYDRO | 150 | | | 150 | |
| 15 | KUNDAH-5 | TN | SOG | | HYDRO | 30 | | 30 | | |
| | | | | | **HYDRO** | **673** | | **453** | **220** | |
| 16 | NEYVELI EXT | TNNLC | SOG | | N-LIGN | 420 | | 210 | 210 | |
| | | | | | **N-LIGN** | **420** | | **210** | **210** | **0** |
| 17 | A P Small | AP | SOG | | NAPH6 | 985 | | 985 | | |
| | | | | | **NAPHTHA** | **985** | | **985** | | |
| 18 | KAIGA U1 2 | NPCS | SOG | | NUCLEAR | 440 | | 440 | | |
| 19 | KAIGA3 4 | NPCS | SOG | | NUCLEAR | 440 | | | 440 | |
| | | | | | **NUCLEAR** | **880** | | **440** | **440** | |
| 20 | SRISAILAM LBPH | AP | SOG | | PSTOR | 900 | | 900 | | |
| | | | | | **PSTOR** | **900** | | **900** | **0** | |
| | | | | | | **6141 6** | | **4351.6** | **1790** | |

| SUMMARY | | | | | |
|---|---|---|---|---|---|
| | **HYD+PSS** | **1573** | **1353** | **220** | **0** |
| | **COAL+LIG** | **1840** | **710** | **1130** | **0** |
| | **GAS+LNG** | **9 6** | **9.6** | **0** | **0** |
| | **LIQ FUEL** | **1839** | **1839** | **0** | **0** |
| | **NUCLEAR** | **880** | **440** | **440** | **0** |
| | **TOTAL** | **6141 6** | **4351.6** | **1790** | **0** |

B.8 Power plant database (SOG schemes Eastern and North-eastern Region)- India

| Sl No | Plant Name | State/Agency | Status | Special | Fuel Type | Installed cap comm MW | cand MW | Benefits dunng plan 9th MW | 10th MW | 11th MW |
|---|---|---|---|---|---|---|---|---|---|---|
| | EASTERN+N-EASTERN REGION | | | | | | | | | |
| 1 | TENUGHAT-X | BIH | SOG | | COAL1D | 630 | | | 630 | |
| 2 | MUZ PUR-X | BIH | SOG | | COAL3E | 500 | | | 500 | |
| 3 | BAKRESHWAR 1 | WB | SOG | | COAL3E | 630 | | 630 | | |
| 4 | BAKRESHWAR-2 | WBIPP | SOG | | COAL3E | 420 | | | 420 | |
| | | | | | COAL | 2180 | | 630 | 1550 | 0 |
| 5 | DHANSIRI+LBP | ASS | SOG | | HYDRO | 120 | | | 120 | |
| 6 | CHANDIL+N KOEL | BIH | SOG | | HYDRO | 32 | | 32 | | |
| 7 | UM UMTRU-V | MEGH | SOG | | HYDRO | 18 | | | 18 | |
| 8 | SERLUI-B | MIZO | SOG | | HYDRO | 9 | | 9 | | |
| 9 | DOYANG | NEEP | SOG | | HYDRO | 75 | | 75 | | |
| 10 | LIKMRO | NAGA | SOG | | HYDRO | 24 | | | 24 | |
| 11 | KOPILI EXT | NEEP | SOG | | HYDRO | 25 | | | 25 | |
| 12 | RANGANADI | NEEP | SOG | | HYDRO | 405 | | 405 | | |
| 13 | KOEL KARO | NHPCE | SOG | | HYDRO | 710 | | | 710 | |
| 14 | RANJIT | NHPCE | SOG | | HYDRO | 60 | | 60 | | |
| 15 | U INDIRAVATI+3 | ORS | SOG | | HYDRO | 765 | | 606 | 159 | |
| 16 | Rathangchu+Rolep | SIK | SOG | | HYDRO | 39 | | | 39 | |
| 17 | TEESTA-1-4 | WB | SOG | | HYDRO | 67 5 | | 67 5 | | |
| 18 | RAMAN-1 | WB | SOG | | HYDRO | 36 | | | 36 | |
| | | | | | | 2385 5 | | 1254.5 | 1131 | 0 |
| 19 | MANIPUR SMALL | MANI | SOG | | HYDRO | 36 | | 36 | | |
| | | | | | | 36 | | 36 | 0 | 0 |
| 20 | PURLIA PSS | WB | SOG | | HYDRO | 900 | | | 900 | |
| | | | | | | 900 | | 0 | 900 | 0 |
| | Sub-Total-ER+NER | | | | | 5501 5 | | 1920.5 | 3581 | 0 |
| | | | | | HYD+PSS | 3285 5 | | 1254 5 | 2031 | 0 |
| | | | | | COAL+LIG | 2180 | | 630 | 1550 | 0 |
| | SUMMARY | | | | GAS+LNG | 0 | | 0 | 0 | 0 |
| | | | | | LIQ FUEL | 36 | | 36 | 0 | 0 |
| | | | | | NUCLEAR | 0 | | 0 | 0 | 0 |
| | | | | | TOTAL | 5501 5 | | 1920 5 | 3581 | 0 |
| | TOTAL-ALL-INDIA | | | | | 24315 6 | | 11783 1 | 12532 5 | |
| | | | | | HYD+PSS | 13836 | | 4423 5 | 9412 5 | 0 |
| | | | | | COAL+LIG | 5820 | | 3140 | 2680 | 0 |
| | SUMMARY | | | | GAS+LNG | 440 | | 440 | 0 | 0 |
| | | | | | LIQ FUEL | 1900 | | 1900 | 0 | 0 |
| | | | | | NUCLEAR | 2320 | | 1880 | 440 | 0 |
| | | | | | TOTAL | 24315 6 | | 11783 1 | 12532 5 | 0 |

## B.9 Planned capacity addition up to 2005 (Power Systems Master Plan)- Bangladesh

| Sl No | Plant/Site | | Size & Type | Rehabilitation/ Committed/ Planned/ New | Completion year, FY |
|---|---|---|---|---|---|
| | State owned | Private Plants | | | |
| 1 | Shahjibazar | | 2 x 14-MW | Rehabilitation | 1997 |
| 2 | Haripur# 3 | | 1 x 3-MW peaking CT | Rehabilitation | 1997 |
| 3 | Ghorashal #6 | | 1 x 210-MW barge-mounted CT | Committed | 1998 |
| 4 | Khulna | | 1 x 28-MW barge-mounted CT | Rehabilitation | 1998 |
| 5 | Khulna | | 1 x 60-MW barge-mounted CT | Rehabilitation | 1998 |
| 6 | Sikalbaha | | 2 x 28-MW barge-mounted CT | Rehabilitation | 1998 |
| 7 | | Mymensingh | 2 x 30-MW CTs | Committed | 1998 |
| 8 | Rauzan #2 | | 1 x 210-MW ST | Committed | 1999 |
| 9 | Haripur #4 | | 1 x 33-MW peaking CT | | 1999 |
| 10 | Haripur #5, #6 | | 2 x 38-MW steam units (converted to combined cycle) | Committed | 1999 |
| 11 | Siddhirganj #5 | | 1 x 210-MW ST | Committed | 1999 |
| 12 | Shahjibazar | | 3 x 20-MW CTs | Planned | 2000 |
| 13 | Mymensingh #1 | | 1 x 100-MW peaking CT | Planned | 2000 |
| 14 | Sylhet #1 | | 1 x 100-MW peaking CT | Planned | 2000 |
| 15 | Barapukuria #1 | | 1 x 125-MW domestic coal | Committed | 2001 |
| 16 | | Baghabari | 1 x 71-MW CT (1x100 MW CT) | Planned | 2001 |
| 17 | | Khulna #3 | 1 x 210-MW ST (HFO-fired) | Planned | 2001 |
| 18 | Chittagong CT #1 | | 1 x 100-MW peaking CT | Planned | 2001 |
| 19 | Barapukuria #2 | | 1 x 125-MW domestic coal | Committed | 2002 |
| 20 | | Meghnaghat CC #1 | 1 x 300-MW combined cycle | Planned | 2002 |
| 21 | | Meghnaghat CC #2 (Haripur CC) | 1 x 300-MW combined cycle | Planned | 2003 |
| 22 | Chittagong CT #2 | | 1 x 100-MW peaking CT | Planned | 2003 |
| 23 | Chittagong CT #3 | | 1 x 100-MW peaking CT | Planned | 2004 |
| 24 | | Baghabari CC #1 | 1 x 300-MW combined cycle | Planned | 2004 |
| 25 | Chittagong CT #4 | | 1 x 100-MW peaking CT | Planned | 2005 |
| 26 | Chittagong CT #5 | | 1 x 100-MW peaking CT | Planned | 2005 |
| 27 | | Baghabari CC #2 | 1 x 300-MW combined cycle | Planned | 2005 |

Source PSMP, System Planning, BPDP, & Power Cell

## B.9a Capacity addition up to 2005 (Planning Systems Master Plan)-Bangladesh

| Sl. No | Plant/Site State owned | Private Plants | Size & Type | Rehabilitation/ Committed/ Planned/ New | |
|---|---|---|---|---|---|
| 1 | Shahjibazar | | 35-MW | Rehabilitation | 1998 |
| 2 | Ashuganj | | 55-MW ST | Rehabilitation | 1998 |
| 3 | Ghorashal #6 | | 1 x 210-MW ST | Committed | 1998 |
| 4 | Kaptai | | 40-MW Hydro | Rehabilitation | 1998 |
| 5 | | Barge mounted East/West | 3 x 100 MW berge mounted CT/CC/Diesel | New | 1998 |
| 6 | Sikalbaha | | 42-MW barge-mounted CT | Rehabilitation | 1998 |
| 7 | Rauzan #2 | | 1 x 210-MW ST | Committed | 1998 |
| 8 | | Baghabari | 1 x 100 MW CT<br>(1 x 71-MW CT) | Planned | 1999 |
| 9 | | Barisal | 1 x 125 MW CT | New | 1999 |
| 10 | | Bhola Island | 21 MW CT | New | 1999 |
| 11 | | Mymensingh | 2 x 30-MW CTs | Committed | 1999 |
| 12 | Khulna | | 1 x 55-MW ST | | 1999 |
| 13 | Haripur #4 | | 1 x 33-MW peaking CT | Rehabilitation | 2000 |
| 14 | Haripur #5, #6 | | 2 x 38-MW steam units (converted to combined cycle) | Committed | 2000 |
| 15 | Siddhirganj #5 | | 1 x 210-MW ST | Committed | 2000 |
| 16 | Shahjibazar | | 3 x 20-MW CTs | Planned | 2000 |
| 17 | | Haripur CC (Meghnaghat CC #2) | 1 x 300-MW combined cycle | Planned | 2000 |
| 18 | Khulna | | 1 x 165 MW CC | New | 2000 |
| 19 | Barisal | | 40 MW ST for Combined Cycle | New | 2000 |
| 20 | Mymensingh #1 | | 1 x 100-MW peaking CT | Planned | 2001 |
| 21 | Sylhet #1 | | 1 x 100-MW peaking CT | Planned | 2001 |
| 22 | Barapukuria #1 | | 1 x 125-MW domestic coal | Committed | 2001 |
| 23 | | Baghabari CC #1 | 1 x 300-MW combined cycle | Planned | 2001 |
| 24 | | Meghnaghat CC #1 | 1 x 300-MW combined cycle | Planned | 2001 |
| 25 | Chittagong CT #1 | | 1 x 100-MW peaking CT | Committed | 2002 |
| 26 | Chittagong CT #1 | | 1 x 125-MW domestic coal | Planned | 2002 |
| 27 | Barapukuria #2 | | 1 x 100-MW peaking CT | Planned | 2003 |
| 28 | Chittagong CT #2 | | 1 x 100-MW peaking CT | Planned | 2004 |
| 29 | Chittagong CT #3 | | 1 x 100-MW peaking CT | Planned | 2005 |
| 30 | Chittagong CT #4 | | 1 x 100-MW peaking CT | Planned | 2005 |
| 31 | | Baghabari CC #2 | 1 x 300-MW combined cycle | Planned | 2005 |

Source PSMP, System Planning, BPDP, & Power Cell

## B.10 Planned capacity addition up to 2005 (Revised estimates)- Bangladesh

| Sl No | Plant/Site | Onership | Size & Type | Rehabilitation/ Committed/ Planned/ New | |
|---|---|---|---|---|---|
| 1 | Shahjibazar | State owned | 35-MW | Rehabilitation | 1998 |
| 2 | Ghorashal | State owned | 55-MW ST | Rehabilitation | 1998 |
| 3 | Ghorashal #6 | State owned | 1 x 210-MW ST | Committed | 1998 |
| 4 | Kaptai | State owned | 40-MW Hydro | Rehabilitation | 1998 |
| 5 | Barge mounted East/West | Privately owned | 3 x 100 MW berge mounted CT/CC/Diesel | New | 1998 |
| 6 | Sikalbaha | State owned | 42-MW barge-mounted CT | Rehabilitation | 1998 |
| 7 | Rauzan #2 | State owned | 1 x 210-MW ST | Committed | 1998 |
| 8 | Baghabari | Privately owned | 1 x 100 MW CT (1x71 MW CT) | Planned | 1999 |
| 9 | Mymensingh | Privately owned | 2 x 30-MW CTs | Committed | 1999 |
| 10 | Khulna | State owned | 1 x 55 - MW ST | Rehabilitation | 1999 |
| 11 | Haripur #4 | State owned | 1 x 33-MW peaking CT | | 2000 |
| 12 | Haripur #5 #6 | State owned | 2 x 38- MW steam units (converted to combined cycle) | Committed | 2000 |
| 13 | Siddhirganj #5 | State owned | 1 x 210-MW ST | Committed | 2000 |
| 14 | Shahjibazar | State owned | 3 x 20-MW CTs | Planned | 2000 |
| 15 | Haripur CC (Meghnaghat C | Privately owned | 1 x 300-MW combined cycle | Planned | 2000 |
| 16 | Mymensingh #1 | State owned | 1 x 100-MW peaking CT | Planned | 2001 |
| 17 | Sylhet #1 | State owned | 1 x 100-MW peaking CT | Planned | 2001 |
| 18 | Barapukuria #1 | State owned | 1 x 125-MW domestic coal | Committed | 2001 |
| 19 | Khulana #3 | Privately owned | 1 x 210-MW ST (HFO-fired) | Planned | 2001 |
| 20 | Baghabari CC #1 | Privately owned | 1 x 300-MW combined cycle | Planned | 2001 |
| 21 | Meghnaghat CC #1 | Privately owned | 1 x 300-MW combined cycle | Planned | 2001 |
| 22 | Chittagong CT #1 | State owned | 1 x 100-MW peaking CT | Planned | 2002 |
| 23 | Barapukuria #2 | State owned | 1 x 125-MW domestic coal | Committed | 2002 |
| 24 | Chittagong CT #2 | State owned | 1 x 100-MW peaking CT | Planned | 2003 |
| 25 | Chittagong CT #3 | State owned | 1 x 100-MW peaking CT | Planned | 2004 |
| 26 | Chittagong CT #4 | State owned | 1 x 100-MW peaking CT | Planned | 2005 |
| 27 | Chittagong CT #5 | State owned | 1 x 100-MW peaking CT | Planned | 2005 |
| 28 | Baghabari CC #2 | Privately owned | 1 x 300-MW combined cycle | Planned | 2005 |

Source PSMP, System Planning, BPDP, & Power Cell

**B.10a Planned capacity addition up to 2005(Unsolicited proposals)- Bangladesh**

| Sl No | Plant/Site | Ownership | Size & Type | Rehabilitation/ Committed Planned/ New | | |
|---|---|---|---|---|---|---|
| 1 | Shahjibazar | State owned | 35-MW | Rehabilitation | 1998 | |
| 2 | Ghorashal | State owned | 55-MW ST | Rehabilitation | 1998 | |
| 3 | Ghorashal #6 | State owned | 1 x 210-MW ST | Committed | 1998 | |
| 4 | Kaptai | State owned | 40-MW Hydro | Rehabilitation | 1998 | |
| 5 | Barge mounted East/West | Privately owned | 3 x 100 MW barge mounted CT/CC/Diesel | New | 1998 | Solicited, Bid invited |
| 6 | Sikalbaha | State owned | 42-MW barge-mounted CT | Rehabilitation | 1998 | |
| 7 | Rauzan #2 | State owned | 1 x 210-MW ST | Committed | 1998 | |
| 8 | Baghabari | Privately owned | 1 x 100 MW CT (1x71-MW CT) | Planned | 1999 | Solicited |
| 9 | Mymensingh | Privately owned | 2 x 30-MW CTs | Committed | 1999 | Solicited |
| 10 | Khulna | State owned | 1 x 55-MW ST | Rehabilitation | 1999 | |
| 11 | Haripur #4 | State owned | 1 x 33-MW peaking CT | | 2000 | |
| 12 | Haripur #5, #6 | State owned | 2 x 38-MW steam units (converted to combined cycle) | Committed | 2000 | |
| 13 | Siddhirganj #5 | State owned | 1 x 210-MW ST | Committed | 2000 | |
| 14 | Shahjibazar | State owned | 3 x 20-MW CTs | Planned | 2000 | |
| 15 | Haripur CC (Meghnaghat CC #2) | Privately owned | 1 x 300-MW combined cycle | Planned | 2000 | Solicited |
| 16 | Mymensingh #1 | Privately owned | 1 x 100-MW peaking CT | Planned | 2001 | Unsolicited |
| 17 | Sylhet #1 | Privately owned | 1 x 100-MW peaking CT | Planned | 2001 | Unsolicited |
| 18 | Barapukuria #1 | State owned | 1 x 125-MW domestic coal | Committed | 2001 | |
| 19 | Khulna #3 | Privately owned | 2 x 140-MW ST (HFO-fired) | Planned | 2001 | Unsolicited |
| 20 | Baghabari CC #1 | Privately owned | 1 x 300-MW combined cycle | Planned | 2001 | Solicited |
| 21 | a) Barishal & Khulna | Privately owned | a) 2 x 156-MW CC | Planned | 2001 | Unsolicited |
| | b) Bohala (Baghabari CC #2) | Privately owned | b) 1 x 20-MW CT | | 2001 | |
| 22 | Meghnaghat CC #1 | Privately owned | 1 x 300-MW combined cycle | Planned | 2001 | Solicited |
| 23 | Chittagong CT #1 | State owned | 1 x 100-MW peaking CT | Planned | 2002 | |
| 24 | Barapukuria #2 | State owned | 1 x 125-MW domestic coal | Committed | 2002 | |
| 25 | Chittagong CT #2 | State owned | 1 x 100-MW peaking CT | Planned | 2003 | |
| 26 | Chittagong CT #3 | State owned | 1 x 100-MW peaking CT | Planned | 2004 | |
| 27 | Chittagong CT #4 | State owned | 1 x 100-MW peaking CT | Planned | 2005 | |
| 28 | Chittagong CT #5 | State owned | 1 x 100-MW peaking CT | Planned | 2005 | |

Source PSMP, system Planning, BPDP, & Power Cell

### B.11 Existing power stations-Pakistan

| Station Name | Plant Type/ Fuel | Units | Declared Net Capacity (MW) |
|---|---|---|---|
| Tarbela | Hydro | 10 x 175<br>4 x 432 | 3478 |
| Muzaffargarh | Steam | 5 x 210<br>320 | 1370 |
| Hubco (private) | Oil | | 1292 |
| Port Qasim | Steam/oil | - | 1260 |
| Kot Addu | Gas turbine | 8 x 100<br>2 x 132<br>133 | 1197 |
| Guddu | Combined cycle | - | 1015 |
| Mangla | Hydro | 10 x 100 | 1000 |
| Jamshoro | Steam/oil | 4 x 220 | 880 |
| AES Lalpir (private) | | | 727 |
| Guddu | Steam | 2 x 110<br>2 x 210 | 640 |
| | Combined cycle | 2 x 100<br>2 x 135<br>145 | 615 |
| | Combined cycle | 2 x 112<br>2 x 100 | 424 |
| | Gas Turbine | 4 x 100 | 400 |
| Korangi Thermal | Thermal | - | 316 |
| Multan | Steam | 4 x 65 | 260 |
| Warsak | Hydro | 6 x 40 | 240 |
| | Gas Turbines | 8 x 25 | 200 |

Source Water and Power Development Authority (WAPDA)

## B.12 Planned capacity addition -Pakistan

| Under Construction<br>Private | Fuel | Capacity | Date of Operation |
|---|---|---|---|
| Japan Power | Fuel Oil | 120 | Dec-98 |
| rousch Power | Fuel Oil | 412 | Dec-98 |
| Fauji Kabirwala | Gas | 157 | Dec-98 |
| Liberty Power | Gas | 235 | Dec-98 |
| Public Sector Projects | | | |
| Chasma Nuclear | Nuclear | 325 | Oct-99 |
| Chashma Low Head | Hydro | 184 | Feb-00 |
| Gazi Barotha | Hydro | 290 | Nov-00 |
| Gazi Barotha | Hydro | 290 | Feb-00 |
| Gazi Barotha | Hydro | 290 | Mar-00 |
| Gazi Barotha | Hydro | 290 | May-00 |
| Gazi Barotha | Hydro | 290 | Jul-00 |

Source Water and Power Development Authority (WAPDA)

## Crude Oil Reserves Fieldwise

Unit Million US Barrels

| FIELD | Operator Company | Original Recoverable Reserves | Cumulative Production | Balance Recoverable Reserves |
|---|---|---|---|---|
| Balkassar | POL | 33 260 | 33.066 | 0 194 |
| Dhulian | POL | 41 400 | 41.192 | 0 208 |
| Joyamair | POL | 10 450 | 7.244 | 3 206 |
| Khaur | POL | 4 310 | 4.193 | 0 117 |
| Meyal | POL | 49 304 | 37.661 | 11 643 |
| Minwal | POL | 3 740 | 0.097 | 3 643 |
| Pariwali | POL | 3 240 | 0.617 | 2 623 |
| Pindori | POL | 12 850 | 0 790 | 12 060 |
| Bagla | OGDC | 0 070 | 0 070 | 0 000 |
| Bhal Syedan © | OGDC | 0 170 | 1 514 | -1 344 |
| Bobi © | OGDC | 5 010 | 0 010 | 5 000 |
| Buzdar & Buzdar North © | OGDC | 0 280 | 3 540 | -3 260 |
| Chak-Naurang | OGDC | 5 090 | 2 114 | 2 976 |
| Dakhni © | OGDC | 10 560 |  | 10 560 |
| Daru | OGDC | 0 290 |  | 0 290 |
| Dhamraki | OGDC | 0 320 |  | 0 320 |
| Dhodak © | OGDC | 17 000 | 2 345 | 14 655 |
| Fimkassar | OGDC | 20 870 | 8 770 | 12 100 |
| Ghotana | OGDC | 0 400 | 0 166 | 0 234 |
| Kal | OGDC | 3 660 | 1 242 | 2 418 |
| Kunar | OGDC | 24 370 | 2 120 | 22.250 |
| Lashari Centre | OGDC | 11 070 | 5 626 | 5 444 |
| Lashari East | OGDC | 0 037 | 0.037 | 0 000 |
| Lashari South© | OGDC | 0 040 |  | 0 040 |
| Missakaswal | OGDC | 11 860 | 7 730 | 4 130 |
| Mithrao | OGDC | 0 230 |  | 0.230 |
| Nur | OGDC | 0 060 |  | 0.060 |
| Pasakhi & Pasakhi North | OGDC | 11 100 | 9 699 | 1.401 |
| Qadirpur | OGDC | 4 200 | 0 172 | 4 028 |
| Rajian | OGDC | 9 810 | 1 459 | 8 351 |
| Sadakal © | OGDC | 2 447 | 2 447 | 0 000 |
| Sono | OGDC | 9 450 | 6 877 | 2 573 |
| Tando Alam | OGDC | 22 420 | 10 211 | 12.209 |
| Thora | OGDC | 16 010 | 11 288 | 4 722 |
| Toot | OGDC | 15 800 | 11 823 | 3 977 |
| Akri North | UTP | 3 568 | 2 049 | 1 519 |
| Bachal | UTP | 0 052 | 0 025 | 0 027 |
| Bari | UTP | 2 215 | 1 861 | 0 354 |
| Bhatti © | UTP | 1 923 | 0 812 | 1 111 |
| Bukhari © | UTP | 1.782 | 1 208 | 0 574 |
| Buzdar South & South Deep | UTP | 1 971 | 0.152 | 1 819 |
| Dabhi & Dabhi South | UTP | 5 206 | 4 035 | 1 171 |
| duphri | UTP | 0 109 |  | 0 109 |
| Ghungro | UTP | 2 351 | 1 631 | 0 720 |
| Golarchi © | UTP | 0.209 | 0 186 | 0 023 |
| Halipota | UTP | 1 396 | 0 777 | 0 619 |
| Jabo | UTP | 0.032 |  | 0 032 |

Unit. Million US Barrels

| FIELD | Operator Company | Original Recoverable Reserves | Cumulative Production | Balance Recoverable Reserves |
|---|---|---|---|---|
| Jagir | UTP | 4.019 | 0.773 | 3.246 |
| Jalal | UTP | 0.194 | 0.159 | 0.035 |
| Kato | UTP | 0.194 | | 0.194 |
| Khaskheli | UTP | 11.322 | 9.404 | 1.918 |
| Khorewah & Khorewah Deep | UTP | 2.298 | 0.701 | 1.597 |
| Koli © | UTP | 0.702 | 0.305 | 0.397 |
| Laghari | UTP | 21.337 | 20.156 | 1.181 |
| Liari | UTP | 5.135 | 4.626 | 0.509 |
| Mahi | UTP | 0.030 | 0.017 | 0.013 |
| Matli | UTP | 0.166 | 0.157 | 0.009 |
| Mazari | UTP | 25.119 | 20.961 | 4.158 |
| Mazari South & deep | UTP | 16.910 | 9.747 | 7.163 |
| Meyun Ismail | UTP | 2.531 | 0.632 | 1.899 |
| Mukhdumpur | UTP | 0.557 | 0.315 | 0.242 |
| Nakurji | UTP | | | 0.000 |
| Nari | UTP | 0.019 | 0.019 | 0.000 |
| Paniro | UTP | 0.929 | 0.106 | 0.823 |
| Pir | UTP | 0.035 | | 0.035 |
| Rind © | UTP | 0.155 | | 0.155 |
| Sakhi | UTP | 6.034 | 0.217 | 5.817 |
| Sonro © | UTP | 0.911 | 0.317 | 0.594 |
| Tajedi | UTP | 1.529 | 0.989 | 0.540 |
| Tangri | UTP | 5.353 | 2.538 | 2.815 |
| Turk & Turk deep © | UTP | 3.046 | 1.278 | 1.768 |
| Zaur & Zaur deep | UTP | 1.456 | 0.003 | 1.453 |
| Bhangali | OXY | 3.069 | 2.486 | 0.583 |
| Dhurnal | OXY | 49.113 | 47.534 | 1.579 |
| Ratana © | OXY | 1.333 | 0.948 | 0.385 |
| Savi Ragha (C) | BG | 1.350 | | 1.350 |
| Adhi © | PPL | 10.221 | 7.038 | 3.183 |
| **TOTAL** | | **557.059** | **358.282** | **198.777** |
| **Million TOE** | | **74.73** | **48.07** | **26.67** |
| | | | | |
| Of which | POL | 158.554 | 124.86 | 33.694 |
| | OGDC | 202.624 | 89.26 | 113.364 |
| | UTP | 130.795 | 86.156 | 44.639 |
| | OXY | 53.515 | 50.968 | 2.547 |
| | BG | 1.350 | | 1.350 |
| | PPL | 10.221 | 7.038 | 3.183 |

* Reserves not yet estimated

** Production exceeded original recoverable reserves

© Condensate

Source DGPC